Nova Scotia

Report of the Commission of Inquiry on Uranium

January 30, 1985

Nova Scotia

URANIUM INQUIRY
— NOVA SCOTIA

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January 30, 1985

His Honour [illegible] Lieutenant Governor in Council
Province of [illegible] Scotia

May it please Your Honour:

By Order in Council 82-200 dated the 9th day of February, A.D., 1982, the undersigned was appointed to be a Commissioner under the Public Inquiries Act to inquire into and make recommendations to the Governor in Council respecting all aspects of exploration, development, mining, processing, storage, waste management and transportation of uranium in any form, and any substance or activity associated therewith or affected thereby, including, in particular, matters relating to safe environmental procedures in exploration and mining thereof.

I respectfully submit herewith to your Honour my report prepared further to my instructions as a Commissioner appointed pursuant to the above-noted Order in Council.

Robert J. McCleave

Robert J. McCleave
Commissioner

FOREWORD

The Government of Nova Scotia established a public Inquiry into certain matters relating to Uranium under the Public Inquiries Act on February 9, 1982. The Inquiry so established with its commissioner Robert J. McCleave, B.A., LLB., Q.C., D.C.L., a Judge of the Provincial Court, became known as Uranium Inquiry - Nova Scotia. The Order-in-Council is set out in Appendix A.

The Commission first set out to find out, in a public way, what Nova Scotians regarded as the issues surrounding uranium. (See Appendix B). Accordingly it held a series of 44 public meetings throughout the Province during 1982. This constituted Phase I of the Inquiry. It was proposed to hold further Phases after the issues had been identified at Phase I. But a major event occurred, involving Kidd Creek Mines Limited, which indicated that it did not wish to participate further in the Inquiry because of general economic conditions. The Commission sympathized with and understood the position of this Company which had spent a great deal of money without now asking for a return.

The effect of this step by Kidd Creek, (as this Company will now be identified), was to take away a bread and butter issue from the Inquiry and substitute discussion of a long-term possibility. The purposes of subsequent phases, which would have brought competing interests together in confrontation of witnesses and argument, would not have been practical. It seemed to the Commission more desirable to put such confrontation into an arena when (if ever) a practical issue would arise. That practical issue would be whether uranium should be explored for, and mined in Nova Scotia at some specific site. At that stage it would be worthwhile from the public interest to have monies expended on helping a tribunal determine whether there should be such exploration and mining.

(The alternative would have been financial waste. If the Commission had offered public funding to the dozens of parties it would have cost the taxpayers millions of dollars and not achieved practical results. The Commission incurred considerable enmity from a few sources because of its adamant refusal to countenance such payments. If public monies are to be given to parties, then such should be used when there is a public hearing process going on which would determine whether there should be exploration or whether a uranium mine should be established).

It was the hope of the Commission that Phase I would bring forth the views of people in as informal a setting as possible. The view could be presented in any way - brief, speech, song, play - and as a result some unusual presentations were made. See for example the digest of meeting Number 7 at Centre Burlington, at which there was a play involving young farm animals and a parody of Hamlet's famous "to be or not to be".

In addition to the public hearings the Commissioner visited woodlands near New Ross to inspect trespass damage caused during uranium exploration; visited Millett Brook, the site of uranium exploration by the Kidd Creek Company; attended (as a delegate of Canada) a meeting of the Commonwealth Parliamentary Association in Ottawa in 1983 which dealt with modern trends in regulations; visited Bancroft, Ontario, at the site of a now closed small uranium mine; and invited the after thoughts of a number of participants.

The Commission is satisfied that it can carry out its mandate by:

(1) identifying the issues which would accompany any exploitation of uranium in Nova Scotia;

(2) dealing with the process which should lead up to such mining being permitted;

(3) dealing with the practical issue as to what is to be done about the present ban on exploration for minerals, which covers lands staked out for uranium exploration;

(4) dealing with the practical issue as to what is to be done when uranium turns up in sizeable quantity while minerals are being mined.

To accomplish these purposes, the Report will consider the Federal-Provincial division of jurisdiction in uranium matters, problems arising from exploration, problems arising from mining and problems arising from use of uranium. Recommendations will be made with regard to future public hearings to deal with uranium exploration and exploitation, steps to deal with finds of uranium during other mining activities, and some suggestions for the policy considerations of the Provincial government.

RELEVANT LEGISLATION

(1) Constitution of Canada

The constitution of Canada provides for the general distribution of legislative power between the federal and provincial governments. Section 109 of the British North America Act provides that property rights in land and minerals belong to the provinces to the extent that they had not been disposed of by the provinces. Section 92 (13) of the British North America Act gives the provinces legislative authority over "Property and Civil Rights in the Province" and Section 92 (16) gives them authority over "generally all matters of a merely local or private Nature in the Province". As a result, the provinces are given almost total control over almost all aspects of ordinary mining activity. However, Section 92 (10) (c) of the British North America Act allows the Parliament of Canada to declare that certain classes of local works and undertakings are under federal jurisdiction as follows:

> Such works as, although wholly situate within the Province, are before or after their Execution declared by the Parliament of Canada to be for the advantage of two or more of the Provinces.

(2) Atomic Energy Control Act

Chapter A-19 of the Revised Statutes of Canada, 1970, is the Atomic Energy Control Act. Its preamble notes that "it is essential in the national interest to make provision for the control and supervision of the development, application and use of atomic energy, and to enable Canada to participate effectively in measures of international control of atomic energy which may hereafter be agreed upon".

The principal Section is 17 which declares works and undertakings to be works for the advantage of Canada "constructed (a) for the production, use and application of atomic energy, (b) for research or investigation with respect to atomic energy, and (c) for the production, refining or treatment of prescribed substances".

Such substances are defined in Section 2, and include uranium, thorium, plutonium, neptunium, deuterium, their respective derivatives and compounds. There is a very interesting provision in this definition that would add "any other substances that the Board may by regulation designate as being capable of releasing atomic energy, or as being requisite for the production, use or application of atomic energy".

The power to make regulations is contained in Section 9. Such regulations are subject to the approval of the Governor-in-Council, and include

> "(c) respecting mining and prospecting of prescribed substances;
>
> (d) regulating the production, import, export, transportation, refining, possession, ownership, use or sale of prescribed substances and

any other things that in the opinion of the Board may be used for the production, use or application of atomic energy;

(e) for the purpose of keeping secret information respecting the production, use and application of, and research and investigation with respect to, atomic energy, as in the opinion of the Board, the public interest may require."

(Certain provisions of the Atomic Energy Control Act have been tested in the Supreme Court of Canada. In 1983 the Court heard argument in a case involving the Eldorado Nuclear Limited, and Uranium Canada Limited, arising out of the Combines Investigation Act. The two companies were charged with conspiring with others to unduly lessen competition in the production or sale of uranium products in Canada. The two companies protested that they were immune to prosecution because they were agents of the Crown. In other words, they asserted that they were immune from criminal liability.

(The majority decision, which upheld this position, was written by then Mr. Justice (now Chief Justice) Dickson. Each company was found to be a Crown agent "for all its purposes" and thus given the benefit of Crown immunity. "There is immunity from (taxing statutes and criminal statutes) as long as the corporations are acting within their respective authorized purposes."

(Was price fixing outside their authorized purposes? Mr. Justice Dickson wrote "there is nothing in the statutory framework or in the letters patent of either Company to suggest that agreements or arrangements to lessen competition in the production, sale or supply of uranium are extraneous to the state purposes for which the two Companies were incorporated."

(The Dickson decision represented the views of Chief Justice Laskin and Messrs. Justices Ritchie, Beetz, and Chouinard. There was a partial dissent by Madame Justice Wilson, with whom Mr. Justice McIntyre agreed. "I have serious doubts that Parliament ever intended the respondents to have a carte blanche to engage in illegal activities on behalf of the Crown and to encourage other citizens to do likewise." She noted that co-conspirators who were not given Crown immunity would be exposed to the full rigors of the law.)

(3) The Fisheries Act (R.S.C. 1970, ch. F-14, amended 1976-77 Statutes of Canada, Ch. 35).

Section 33 includes pollution control provision which prohibit the deposit of substances which are deleterious to fish, fish habitat or man's use of fish. Section 31 of the Fisheries Act is concerned with any physical actions that might cause physical disruption or alteration of fish habitats.

DIVIDING LINE

In practice, provincial jurisdiction in uranium matters gives way to federal jurisdiction when there is removal of uranium in excess of 10 kilograms in a concentration exceeding 0.55% grade in one calendar year.

(4) The Environmental Protection Act of Nova Scotia

This was passed by the legislature in 1973, and amended in 1975. It replaced two earlier statutes, the Environmental Pollution Control Act of 1970 and the Environmental Protection Act of 1972.

Its principal sections insofar as uranium exploration and mining are concerned are:

Section 2 (c) in which "contaminant" is defined, including "radiation ... and includes any transfer of energy present in the environment which causes a detrimental variation or alteration of the environment as a result directly or indirectly of the activities of man.

Section 2 (f) in which "detrimental variation or alteration" is further defined;

Section 2 (f) in which "waste" is defined to include tailings;

Section 6 in which the Governor-in-Council may appoint an interdepartmental committee dealing with the preservation and protection of the Environment;

Section 8 in which the powers of the Minister of the Environment are set forth. One is "(c) investigate and control problems of pollution, waste management, waste disposal" and another is "(h) develop and recommend methods and plans for the disposal of liquid and solid wastes ..."; and "(o) regulate and control the location, construction and operation of any plant that will or is likely to discharge waste or a contaminant into the environment or otherwise cause pollution";

Section 9 in which an Environmental Control Council is established embracing a vast spectrum of people;

Section 17 in which the functions and powers of the Council are set forth, including authority by the Minister to "hold hearings in relation to ... any ... matter pertaining to the preservation and protection of the environment and report and make recommendations to him in relation thereto";

Section 18 in which the powers of such a Council hearing are set out;

Section 22 in which the responsibilities of the Minister are set out including one to "ensure that all practical measures are taken ... to preserve the environment from deterioration";

Sections 23 and 24 in which permits are required from the Minister before waste may enter the environment (but see Section 51 (b) in which there may be exemptions);

Section 26 in which the Minister has power to deal with contraventions by halting or limiting their rate, or having the right to install, replace or alter control equipment;

Section 27 in which there is a review by the Environmental Control Council or its Executive Committee of the permit powers exercised by the Minister under Section 23 and 26, and the power to make recommendations which may be accepted or rejected;

Section 28 and subsequent sections give the Minister the power to deal with the construction or operations of plants which pollute;

Section 37 in which this Act is made paramount over others;

Section 40 in which the Minister with the approval of the Governor-in-Council may purchase land for the disposal of toxic materials;

Section 41 in which the Minister may enter into agreements with the Government of Canada "to carry out the purposes of this Act";

Section 42 and subsequent sections by which inspectors are appointed and their powers defined;

Section 48 in which penalties are set out for breaches of the Act and its regulations (not more than $5,000 for a first conviction, and not more than $10,000 "for everyday or part thereof" for subsequent convictions for such offence);

Section 51 in which the regulatory powers of the Minister are set forth (a right of appeal to the County Court is provided by Section 53 to persons aggrieved or refused permits);

Section 54 in which the Minister may take action to remedy pollution and recover such expenses or recover damages "where the pollution cannot effectively be remedied".

(5) The Protection of Property Act

It has been in force in Nova Scotia since June 26, 1982. By Section 3, it creates an offence, punishable on summary conviction by a fine up to $500, when a person without legal justification or permission "enters on premises that is ... acreage managed for agriculture crops" or enters on premises that is apparently a tree plantation area or a Christmas tree management area or "enters on premises where entry is prohibited by notice."

Section 11 (1) provided that the court may order restitution of up to $2,000 where damage has been suffered and, by Section 11 (3), the court may order that costs up to $500 be paid for private prosecution.

The Act specifies by Section 14 that it does not restrict "the availability of injunctive relief or any other civil remedy for trespass to property."

(6) The Mineral Resources Act

This is the principal authority in Nova Scotia for the inspection of all mines and for the granting of mines' leases, and prospecting is also dealt with. The Act provides also that ownership of minerals excepting only limestone, gypsum and building materials shall reserve to the Crown no matter what grants of Crown land may have said (Section 3 and 4).

The Act (M-16 in the ongoing loose-leaf collection of Statutes of Nova Scotia) has been in force since June 1, 1975, and has been amended since. Its principal Sections, as they pertain to the Inquiry, are:

Section 12 - certain information obtained in an official capacity by any inspector, engineer or geologist on the staff of the Department of Mines and Energy or certain persons designated by the Minister "to carry out an inspection or investigation relating to the mineral industry" (from definition section dealing with "officer") may become privileged and not disclosable "to any court";

Section 16 - the Minister with the approval of the Governor-in-Council may make regulations

"(a) respecting the disposal of tailings ... or any noxious or deleterious substances upon any lands or into any waters;"

"(b) respecting the restoration, reclamation and rehabilitation of a mine or mining lands";

"(c) governing the operation of any mine ...".

Section 17 - the method of applying for a mineral right is set out, and by definition "mineral right" can be a license issued under Sections 41, 48 and 68, or right granted under Section 24;

Section 21 - a licensee shall notify the Minister of all contractors performing work at its locations;

Section 23 - a license shall entitle its holder to search and prospect subject to the rights of the land owner "covered by such license;"

Section 24 - the Minister may withdraw any lands from application for a license "for all or certain minerals" but these lands "may be worked, licensed or leased under an agreement or arrangement with the Crown in such manner and upon such terms and conditions as may be provided by order of the Governor-in-Council;" and the Governor-in-Council may reopen for an application for a license any lands withdrawn "for all or certain minerals";

Section 25 - licenses may be applied for upon payment of the prescribed fees (the holders of mineral rights seem to have 15 days of grace after the expiry of their licenses - see Section 30);

Section 35 - exploration licenses are given and
&
41 "constitute authority to search, prospect and mine all or specified minerals ... for purposes of investigation, examination or test only;" provisions are made for their renewal, one being a requirement that a certain amount of work be done - 10 days per year; the licenses are to be in a prescribed form;

Section 47 - Leases of 20 years to mine, their re-
&
63 newal, forfeiture transfers, surrender and abandonment are covered. How to deal with failure to comply with conditions, stipulations, covenants or provisions is set forth;

Section 66 - Entry for prospecting purposes is dealt
&
68 with. "No licensee shall enter upon or prospect any private lands included in his license except with the consent of the owner or tenant or occupant or under special license from the Minister" but if such permission cannot be obtained an application may be made to the Minister who shall hear prospective prospector and owner and decide whether to grant a special

license, upon such terms and conditions as he may think proper and may determine the amount of any compensation;

Section 69 - Lessee must obtain the right to enter upon or use for mining purposes private lands;

Section 82 & 88 - A lease is required before a mine to extract minerals may be opened, worked or operated, and the applicant must submit reports and plans and must use "the most economical and efficient method";

Section 89 & 93 - Milling licenses are required.

TRESPASS

The damage done to woodlands by prospectors for uranium was raised at the first meeting held by the Inquiry, at New Ross. Subsequently the Inquiry revisited New Ross, and travelled afoot in some of the areas where damage had been done during the cutting of lines.

At the height of the prospecting, the Department of Mines and Energy had placed an advertisement, entitled "Notice to Landowners" in many weekly newspapers.

Every entry upon private lands must be done with the consent of the owner, in the first instance, although the prospector may obtain a special license to enter from the Minister of Mines after notice to the owner and hearing from both parties.

There were two special areas of difficulty found by the Inquiry. One, as old as the hills, is that property lines are not always clear. The other, as new as yesterday, is that the largest tree in Nova Scotia can be felled in moments by a chain saw. The Commissioner considered that some of the trees cut down should have been left standing.

Since the Inquiry opened the Provincial legislature has passed the Protection of Property Act. Its purpose seems to be to help farmers with woodlots whose property was overrun by hunters, but there seems to be no reason why the Act should not be used by woodlot owners overrun by trespassing prospectors. The remedy however is mostly penal, that is, payment of fines after hearings in the Provincial Courts. The civil remedy for injury done to one's property is the classic one for damages, although up to $2,000 may be ordered by the Provincial Court.

Some property owners have not as yet received compensation for the injury done to their woodlots by the cutting down of trees.

PROSPECTING AND EXPLORATION

At the exploration stage, it is often a technique to sample the water in wells to determine if uranium is present in the neighbourhood. It seems to the Inquiry that such sampling if carried out more than once could serve a double purpose, that is, to also find out if there were such changes in the readings as to indicate important disturbances to the normal chemical balance in the well water.

There is also the risk that trenching and the use of drill holes in searching for uranium could expose uraniferous material to rainfall, moving ground water and aquifers, as well as release radon to the air.

One of the requirements of the Special Uranium Exploration Licence is for an annual report as to all geological investigations conducted on the property "including levels of radioactivity recorded at all levels of ground disturbance". The Department of the Environment will also have information on access roads to exploration sites, which must be surveyed radiometrically.

The Commission was impressed by the general state of order and care at Kidd Creek's operations at Millet Brook where the most advanced exploration had been carried out.

The Medical Society of Nova Scotia (Meeting 25, July 14) recommended that an environmental assessment study should be carried out and documented as to the effects of exploration for uranium. With such completed and "with rigidly regulated safeguards properly monitored and directed at safety, we accept that uranium exploration could be allowed to resume without exposing Nova Scotians to unnecessary health hazards".

Several presentations including that of the Medical Society of Nova Scotia suggested that the existing guidelines for exploration should be established as regulations. The Department of Mines and Energy has replied that the special uranium exploration licences are issued as Orders-in-Council under the Mineral Resources Act, and breaches would be subject to the penalties imposed by that Act or, if pollution resulted, to penalties under the Environmental Protection Act.

The Nova Scotia Department of the Environment (Meeting 44, October 8) considered that the environmental effects associated with uranium exploration were not considered to be important when appropriate measures to control pollution were followed.

In its Appendix H, the Nova Scotia Department of the Environment reported on the detailed baseline data collection program for Millet Brook. Senes Consultants, reporting to Aquitaine Company of Canada Ltd. (the predecessors of Kidd Creek Mines Ltd.) summarized that "the radiological water quality in the Millet Brook study area is generally indicative of normal, background levels. With the exception of one uranium measurement, the radio-nuclide levels meet all present drinking water standards. Only the uranium levels measured in the fall and the radon in groundwater levels indicate the presence of any mineralization in the area."

Several presentations, including the imaginative play involving young farm animals at Centre Burlington, referred to the use of helicopters in the initial stages of exploration. The Inquiry was not advised of specific instances in which damage was alleged, and the Federal Department of Transport was cooperative in checking and confirming that no major complaints were received.

HEALTH AND ENVIRONMENT

One could live near uranium, or one of the elements in its cycle, and not immediately recognize the hazards. As several briefs have pointed out, the radiation from such sources has no taste, no sound, no form by which it can be seen, and no odour. Its damages can be devastating.

This lack of taste, noise, sight and smell makes it a formidable enemy indeed.

The hearing heard many representations as to the hazards posed by uranium. These hazards covered the entire uranium cycle as it is known in mining. Uranium by its nature must break down and eventually become lead. While so breaking down this unstable element can enter water systems. Indeed one of the indications of the presence of uranium is that it exists in well water, that is, that it has leaked into the water courses lying under the ground of Nova Scotia and has found its way into wells.

This will be a legitimate mining issue, when the uranium is found in levels unacceptable to health in the water supply near deposits which could lead to uranium mining; it is not a legitimate mining issue but is still a cause for health concern when it indicates the presence of non-commercial amounts of uranium elsewhere. This Inquiry had to deal with the mandate given to it, and that is to deal with the presence of uranium as a mining issue. It may be noted that the health problems associated with the presence of uranium in water supplies is being dealt with by a task force established by the provincial Government in October, 1980.

There was an ample range of issues for the Inquiry to deal with on the health front. These occurred at every step of the way, from the exploration for uranium through the mining, milling process, through its departure from the mill to its customer, to the closing down of the mine and the proper management of the tailings. Of these four stages, it can be noted that special standards of care were always necessary because of the hazardous nature of the substance. At the first three stages, mankind has put into effect its technical crafts - either voluntarily or by regulation or by a combination of the two - which have largely solved the legitimate concerns of reasonable people. For example, trenching in exploration and mining has to be carried out with great care that ventilation will not expose the prospectors, miners and mill technicians to the hazards from radon, or the alpha, beta or gamma radiation from the uranium ore.

Part of everyday living has to be one's encounter with a series of risks, as any philosopher will theorize or as any driver upon our highways will attest. The complaints of many who fear uranium in any circumstances tend to lose credibility. The complaints may however be legitimate when related to specific circumstances. For example, one would not mine uranium without extreme care as to ventilation in the mine.

The final stage of the mining process, the management of the tailings after the mine is closed down was mentioned as a matter of concern by almost every presenter whether pro or con. The decay of uranium takes place over a long period of time, thousands of more times than any one civilization for which we have history. The principal concerns were whether containment devices such as dams or linings would remain intact, whether such holding areas could withstand natural disasters such as floodings, and whether the volatile nature of uranium's decay into lead would play havoc with dams and linings. There can be no certain answers when the uranium age as we know it is only a minute part of the several thousands of generations which will follow the 850,000 Nova Scotians who inhabit this province today.

MINING, MILLING AND JURISDICTION

There are occupational hazards associated with any type of mining. In addition, uranium mining brings in the hazards arising from radiation. The Inquiry considers its mandate to be concerned with the hazards that arise from the added factor of radiation.

It must also be noted that uranium as a natural resource would be considered a matter for federal jurisdiction. The Atomic Energy Control Act was passed by Parliament in 1946, providing that "all works and undertakings ... (c) for the production, refining or treatment of prescribed substances are ... declared to be works ... for the general advantage of Canada." Uranium is included as a prescribed substance.

The effect of this Federal Act is to limit the capacity of the province to regulate uranium mining. Questions arise as to what if any role there is for the province in its traditional fields of occupational health and safety, and environmental protection. The province of Saskatchewan has answered these questions by putting standards for these into its surface lease agreements - in other words, it has demanded as a proprietor what it could not demand as a province. In practice there has been a measure of cooperation between Atomic Energy Control Board and the province, Ontario and Saskatchewan.

This Inquiry will simply note there that once uranium development has passed beyond the prospecting stage the province will lose much of its power for the control of uranium. The provincial Departments of Labour, Health and Environment will find that the AECB has a reasonably flexible approach. (On a practical footing, where there is a conflict between Federal and Provincial laws, Chief Justice Dickson of the Supreme Court of Canada leans toward the doctrine of express contradiction rather than the doctrine of negative implication. See his decision in Multiple Access Ltd. v. McCutcheon (1982) 44 N.R. at pps. 206-7. Should any dispute arise involving the strong powers in the Environmental Protection Act of this province, his leaning may be crucial.) The Inquiry will later make recommendations to prevent jurisdictional disputes.

The position in a nut shell of the contentious areas under our constitution is:

Labour relations - clearly under the jurisdiction of the Canada Labour Relations Board;

Occupational health and safety - probably under the Federal jurisdiction but now being shared, as an example of cooperative Federalism;

Environmental Protection - each side can make a claim to jurisdiction, and any final confrontation to decide the jurisdiction would involve a battle between the province's ownership of land and resources and the federal power under the "peace, order and good government" clause of the constitution. Perhaps the answer will be that jurisdiction is concurrent.

Once the ore containing radionuclides has entered the mining and milling process, the release of dangerous substances is enhanced. As Environment Canada has noted, "The rate of release of these radionuclides will vary with the radionuclides present, ore grade, ore type, and the mining, milling and waste management practices carried out." The Chamber of Mineral Resources has pointed out that a uranium mine in Nova Scotia would be open pit or underground, and "it is impossible to predict which system would be used until the ore grade, depth and shape is known."

Open Pit - The Chamber of Mineral Resources in its brief has relied upon the Bates Royal Commission in British Columbia for a listing of the hazards from blasting, drilling and dust and the preventive steps to be taken. Gamma radiation is the greater danger than alpha radiation from radon daughters, and therefore some workers must carry dosimeters.

Underground - Mines must be well ventilated to deal properly with the release of alpha particles from radon daughters. The other hazards noted for open pit operations also exist.

Milling - In the plant itself the ore is prepared which will lead to the release of radon gas and dust, and chemical processes are used to take the uranium ore from its existing state and transform it into a concentrated compound known popularly as yellowcake. Ventilation is needed to guard against the radon daughters, and the dust, and great care is needed to deal with the liquid effluent.

Transportation - Little was made of the problems arising from the containment of the yellowcake and its transport to its customers. The practices would be governed by Federal legislation and regulations.

Tailings - The most controversial subjects raised before the Inquiry concerned the long-term management of the tailings disposal from the mine-mill cycle, and the use of uranium in nuclear weapons.

The primary health issue raised was that of the hazards of radiation. The widespread fear of cancer and genetic defects provided some tense presentations. Was there any level at which workers could be exposed to radiation from the uranium group of chemicals?

The Inquiry considers that much more will be determined as to safe practices and health hazards in the decade ahead, using information from the uranium mines being operated in Saskatchewan and Ontario. In addition there is the information that may be gathered from the uranium mining experience at Bancroft, Ontario, where there were some 200 miners underground and almost the same number working in the mill. See a subsequent report.

Some presentations suggested that there be no exposure at any level, but this was demonstrated to be folly by those who pointed out that cancer treatment centres would have to be closed down. And would we really want the sun to be forever obscured by thick clouds, to cut down on radiation?

The provincial Department of Health has considered that the dangers from radon are dissipated once one leaves the vicinity of the mine. The Inquiry agrees with this assessment. There is no reputable evidence to challenge this.

The main problem insofar as the health of the general public is concerned, is to keep the tailings under control, and to prevent leaching or leakage into the nearby environment. The Bancroft system is a useful model to examine from time to time since it involves a mine likely to be of similar size to any that might be developed in Nova Scotia, and since it exists in countryside which has farming, recreation, forestry, tourist facilities and a small community. In addition the cost of travel to Bancroft would not be prohibitive.

THE BAN ON MINERAL EXPLORATION

On February 2, 1982, the Minister of Mines and Energy announced measures which in effect halted uranium exploration activities in the Province while this Inquiry investigated environmental and health impacts associated with uranium exploration and mining. It was provided that "Companies or individuals wishing to retain uranium rights in areas previously held under either General Exploration or Special Licences must submit a request for a special Uranium Exploration Licence to the Registrar of Mineral Rights. The area will then be withdrawn from further exploration for all minerals and the request held on file until Cabinet decides what action is to be taken on this issue."

The result was that thousands of acres were withdrawn from exploration for all minerals including uranium. The ban has cut down on the search for non-uraniferous minerals. The Inquiry will make specific recommendations regarding the partial lifting of the ban.

CHANCE DISCOVERIES OF URANIUM

The specific focus of the Inquiry was upon uranium exploitation. The fact is that uranium may crop up in a significant amount during operations for other minerals, not enough to mine but enough to be a hazard. The Inquiry has held informal discussions with officials of the Department of Mines and Energy, and of the Environment. It is satisfied that these two Departments can cope with such a situation, but would add the thought that there should be a requirement for immediate reporting when uranium content in an ore is found to exceed levels which can be determined from time to time by the Departments.

The power to require such could be found pursuant to the Environment Protection Act, and/or contained in any lease between the Department of Mines and Energy and a mining operator or prospector.

A VISIT TO BANCROFT

In the attacks upon uranium mining, much was made of the drastic changes to the environment at Elliot Lake, Ontario (the dead Serpent River winding its lifeless way 50 miles to the Great Lakes was a favourite example). In the counter-attacks, reference was made to a mine in the central plateau of France co-existing with vineyards and other forms of agriculture.

The Commission wanted to see an operation that would be comparable to a small uranium mine in Nova Scotia if such should ever be developed. This brought forth the reference to Bancroft, Ontario. Accordingly a visit was made to that community in late summer of 1984. The visit turned out to be an eye opener.

The uranium mine at Bancroft is not easy to find. It is located on one side of the community of some 2,000 people. The area abounds in lakes and agriculture and woods. The tailings disposal area runs alongside a main road, and this one can find easily if one knows that a well marked ski trail runs over the tailings.

The mine was operated by the Madawaska Mines Limited. It was in the process of being dismantled during the visit of the Commissioner. A vice-president in working clothes was taking apart a wooden frame near a well ventilated wooden building which was situated a few hundred yards from the pit from whence came the uranium ore. The mine had fallen on evil days. It had secured a good contract to provide the fuel for nuclear reactors in Europe, but the market was gone because a public plebiscite in that country had cancelled the contract. The owners decided to dismantle rather than moth ball. This is an important decision because it meant that an otherwise viable mine would fill up with water and would require months of pumping before it could ever become operational again.

The loss of the 400 jobs - 200 in the mine, 200 in the plant - was a bitter blow to Bancroft. A market using uranium for peaceful purposes had been lost. Many could not find other jobs in their beautiful rural area.

The Commission concluded:

(1) That a small uranium mine could operate in a

community without degrading the environment around it;

(2) That the vagaries of the uranium market were such that sudden economic disaster could hit hundreds of families;

(3) That Bancroft provided a model which Nova Scotians could reach easily (less than two hours drive from Ottawa) before making their own decision as to whether there should be uranium mining in this province.

For example, the Ontario Department of Public Health will be able to provide information on cancer experience. The other health issues would also be pursued.

Because it is important to understand the Bancroft experience, the Commissioner asked for two reports from Federal authorities. One was provided by Dr. C.J. Edmonds of the Department of the Environment, whose brief is one of the major documents before the Inquiry. The second was provided by Roy John, who had been an environmental officer with Kidd Creek at the commencement of the Inquiry. When that company indicated that it did not wish to carry on before the Inquiry, Mr. John lost his job in Nova Scotia. He found employment with the Department of Energy, Mines and Resources in Ottawa in its Canada Centre for Mineral and Energy Technology (or CANMET) responsible for the national uranium tailings program. These reports follow.

TAILINGS DISPOSAL

The most common argument advanced against the development of uranium holdings was the long-term management of the waste or tailings. Only a small portion of the unstable element has been extracted, the remainder, freed from its containment in granite or some other rock, has to be dumped. Several examples were given of earthworks or dams which gave way, by those opposed to uranium development, and the damage which resulted. Several techniques were suggested by the proponents such as lining the bottoms of containment areas to prevent leakage or seepage into surrounding water.

The Inquiry concludes that both sides have made the substantial agreement that great care is needed to contain uraniferous matter - the antis would have it that such care cannot be achieved and there should therefore be a prohibition on uranium development, and the cons arguing that modern technology can find solutions. Since the problem raised is less than fifty years and the decay in the tailings is to last for tens of thousands of years, there is no absolute answer.

No suggestion was made to the Inquiry that some process was perhaps available which could hasten the rot of uranium into lead. The abandoned mine at Bancroft will provide some clues as to the ability of an accepted disposal system to cope with the variety of Canadian weather. This disposal field is, as noted elsewhere, under regular inspection by the Federal Department of Mines and Energy.

MARKETS FOR URANIUM

The uses of uranium are in nuclear reactors to generate electricity, in nuclear medicine, and in nuclear weapons. Most of the uranium produced in Canada is exported. Estimates of domestic production made by the

Federal Department of Energy, Mines and Resources in the Canadian Mineral Survey for 1983 show that estimated Canadian requirements for 12 years would be approximately 2,000 tonnes per year, or about one-quarter to one-fifth of projected production capability from existing and committed production centres. The article notes that higher cutoff grades are the trend so that "the overall result was a reduction in the level of resources that are of economic interest in the immediate and near term."

The principal markets for uranium since September 5, 1974 were (in descending order) the U.S.A. and Japan (more than 20,000 tonnes), West Germany, France and the United Kingdom (more than 7,500 tonnes), South Korea, Sweden, Spain, Belgium, Finland and Italy (more than 1,000 tonnes) and Switzerland (150 tonnes).

It is generally accepted that the growth of the uranium industry is largely dependent on the growth of nuclear generating capacity, that is, on the growth of electrical demand. There are of course certain other variables such as stockpiling policies by governments, recycling uranium and plutonium, the possible use of commercial breeder reactors, changes in the roles of renewable and non-renewable resources in satisfying the energy market, or new techniques such as fusion being found competitive. In this province an interesting assessment is being made of the practical possibilities of tidal power while in the sister province of New Brunswick, which can also look upon the awesome tides of the Bay of Fundy, there is an option for the nuclear route to satisfy its energy needs. Nova Scotia coal resources will in time, perhaps early in the next century, come to an end. There is the alternate of the offshore oil/natural gas.

The Saskatchewan Inquiry (Cluff Lake) reached the conclusion, with which this Inquiry agrees, that the role uranium would play in meeting energy needs was "dependent on uncertainties in factors such as the availability of other energy resources and acceptability of nuclear energy, and future political and trade policies (so that) it is not really possible to predict with any degree of accuracy."

The principal selling point for uranium development is its awesome potential to develop electricity at low cost. A few dollars worth can look after the power needs of an average home. The Commissioner recalls the optimism of journalists in the late 40's and early 50's that our automobiles would be powered by pencil-sized uranium batteries. Alas for such dreams, the harnessing of uranium is a problem which is only partly solved. Its use for electrical generation has had to be accompanied by extraordinary standards of care - and an uncertain cost element when a plant reactor has lived its useful term.

The reluctance to expand the use of nuclear reactors has meant the closing of the mine at Bancroft, that is, a small mine has not survived although the giants at Elliot Lake and Uranium City carry on.

The Inquiry questions whether it is wise to assume that the market for nuclear weapons is one which will continue indefinitely.

GENERAL CONCLUSIONS

(1) Methods exist by which uranium can be mined safely. It would have to be determined whether such uranium mining could take place at the one site in Nova Scotia which may prove to be viable and, more particularly, whether the tailings disposal which would be set up near any uranium mine would provide safe storage over an indefinite period of time.

(2) The uranium market for Nova Scotia would be an uncertain one, because the ore resources are not as rich as those now being developed in Ontario and Sackatchewan. There are also anti-uranium mining elements in the population who are concerned about its possible use in nuclear weapons. And, while this is an age productive of great feats such as mankind's ventures into space, the fact is that no one has yet designed a system to deal with the dismantling of nuclear generating stations of electricity and the safe storage of its radioactively impregnated materials.

(3) At first blush it would appear that control over uranium resources of Nova Scotia would pass entirely to the Federal government should the day arrive that uranium is to be developed. There are however methods by which a large measure of control could still be exerted by the Provincial government, and the Inquiry considers that it is in the public interest that there remain such control.

(4) Uranium is an awesome source of energy yet, paradoxically, a wasteful user of its energy. Of the uranium taken from the ground, 1% is used in a nuclear reactor, 14% is part of the waste of that nuclear reactor, and 85% goes into the tailings disposal from the mining-milling. In addition, the chemicals such as barium used in its extraction pose problems to the environment.

(5) There is no level at which the radiation produced by uranium will have no effect. If proper measures such as ventilation, personal cleanliness and adherence to time limits for exposure, the risk can be made acceptable. To find otherwise would be to adopt a line of reasoning which would close down the nuclear medicine facilities which have helped Nova Scotians to live, and, if risky livelihoods were to be eliminated, close

down our fisheries.

(6) Because of the divided nature of the jurisdiction between the Federal and Provincial governments, the public could be faced with several levels of public hearings should the question of resumption of prospecting for, and mining of, uranium arise in the future. It would be better that one set of hearings be held, with specific proposals such as site and method for tailings containment on the agenda.

Section 41 of the Environment Protection Act of Nova Scotia gives the Minister of the Environment the power to enter into agreements with Canada "to carry out the purposes of this Act."

The statement made by the Minister of Development to the Legislature on April 3, 1981 sets out the goals which the Inquiry considers to be appropriate for uranium mining.

(7) While the Inquiry received more than 200 presentations it was odd that nobody really raised the issue of what to do with uranium finds made in such small amounts that would not lend to any attempt at uranium mining. The Inquiry will deal with such a possibility as an environmental issue quite divorced from the mining issue.

RECOMMENDATIONS

In making these recommendations, the Commission would first note to Nova Scotians, who are very familiar with the use of coal as an energy source, that

> "The energy uranium holds is awesome. A pound of enriched fuel contains nearly three million times the energy in a pound of coal. Its radioactive power demands elaborate precautions during plant construction and operation and in the safe disposal of waste - still an unsolved problem and a subject of anxious study both here and abroad."

This quotation is from the special ENERGY issue of the National Geographic Society of February, 1981 (page 67).

JURISDICTION

(1) The Province should assert as much control as it can over its uranium resources. This can be accomplished by declaring its own provincial environmental standards for unacceptable levels. The Commission's preference is for the levels established by the Government of British Columbia, which have been accepted generally by both mining interests and environmentalists. Such levels can then be incorporated in the exploration or mining licenses, and these can still be effective should Federal jurisdiction enter the scene.

(2) The Provincial public service has the expertise and the will in its personnel of the Departments of Mines and Energy, Environment and Public Health - indeed the Commission has been impressed by the quality of the public servants it met during the Inquiry and their ability to stand

unjustified criticism - to deal with the mining, environmental and health issues raised by uranium. It is recommended that a committee be formed from these Departments to establish the levels, or recommend them to Government, that are set forth in Recommendation (1), and in the long run to carry out the other recommendations of the Inquiry by developing or sharing information now available.

RADIATION IN MINING

(3) The Mineral Resources Act and the practices relating to reporting should be amended to require that when radiation is found during exploration or mining operations involving non-uraniferous minerals which is above the levels established by Recommendation (1), that such be reported as quickly as possible.

PROSPECTING

(4) The Inquiry considered that the laws of the Province are now sufficient to protect landowners against wrongful or excessive acts by those prospecting or exploring on their lands. Consideration should however be given to require that such parties who do not usually operate in Nova Scotia post performance bonds or make available some contact in the Province for the settlement of claims, such arrangement to be suitable to the Department of Mines and Energy. The Department should also consider placing restrictions or bans upon the use of chain saws in exploration unless there is specific written consent by the land owner.

(5) Legal remedies are available now for breaches of guidelines

for uranium exploration, but the Commission considers that such should be given the force of regulations, so that breaches can be dealt with in the Courts. The public will be more comfortable if it considers that alleged breaches will be dealt with in the dispassionate atmosphere of the Provincial Court rather than in some Ministerial office. The Minister will probably be more comfortable too.

BAN ON URANIUM EXPLORATION

(6) The ban on exploration for all minerals in lands set out by license for uranium exploration is too sweeping and should be lifted. The mineral rights of Companies holding such licenses can be protected by giving them first rights to finds of uranium within the licensed areas whether they have discovered such or not, upon such terms and conditions as seem just to the Governor-in-Council. The areas licensed and now under ban but not found to contain uranium should be treated under the terms and conditions established by the Department of Mines and Energy. However, the time lapse - between the date of the ban and the adoption of this recommendation plus one month to advise affected parties - should not count against the time requirements of the Mineral Resources Act. When uranium is found in sufficient quantities to justify the exclusion of any area from development now, the time lapse should continue until permission is given.

TIME FOR RECONSIDERATION

(7) During 1990, the Government should determine from its interdepartmental committee established pursuant to Recommendation (2), and

announce publicly, whether the five year ban should be continued. In the meantime, its Committee should keep itself up to date on a variety of matters (most of them set forth in the Digest) such as:

1. advances in the mining process for uranium - see the views of the Federal and Provincial Departments of the Environment, in the views of the various mining briefs and the options suggested by Ralph Torrie;
2. monitoring of the uranium tailings at Bancroft, Ontario, by the Federal Departments of Energy, Mines and Resources and the Environment, and the information available on small uranium mines in France (note the suggestion of Peter Warrian of the United Steelworkers of America);
3. study the health factors from the Bancroft area and other Canadian areas as they relate to the fears held regarding uranium-induced cancers;
4. study the issue raised by Dr. Michael Brylinsky, Elizabeth May and others as to the uptake of radioactivity into the food chain, "biological magnification", and satisfy itself that corrective measures can be put in place.

PUBLIC ANXIETY AS TO USE

(8) The Inquiry considers that much public anxiety would be alleviated should peaceful purposes be found for Nova Scotian uranium. Unrest cannot be

entirely eliminated because the uranium industry has been noted for its secretiveness and has thus laid itself open to misrepresentation and mistrust. It should be noted that Crown corporations in Canada can involve themselves in an international cartel with immunity of prosecution according to the Supreme Court of Canada.

The Inquiry considers that the factors, which should be considered by a Nova Scotian government of the future, in making a determination as to whether further uranium exploration and uranium mining should take place, should include:

1. the right miner - the mining should be done properly, by a company of impeccable and proven standing and financial resources (Kidd Creek would qualify because of its professionalism and resources and high standards of operation);
2. market - the Inquiry's personal preference would be uranium mined in Nova Scotia for use in Nova Scotia. This would mean use for electric power generation. Indeed such a step may be a solution for our heavy water industry of Cape Breton. This would involve a change of Government policy, and the Inquiry considers that such should only be considered when the safe dismantling of a nuclear reactor is shown to be possible. If tidal power or the offshore resources or large new coal mines are able to generate electricity,

> and if the technology for long-term tailings containment is proven, then our uranium resources would have to be developed for world markets. Secure markets should then be found.

PUBLIC HEARINGS

(9) The Inquiry considers that there should be a high level of Federal-Provincial cooperation in any future dealing with this resource. Instead of a series of hearings, for example, by the Environmental Council in Nova Scotia and the Atomic Energy Control Board there should be one set of hearings, specific as to site and other factors. Citizens' groups should be asked to submit names of expert witnesses who would be heard in addition to the experts from the various government departments and agencies.

GENERAL CONCLUSIONS

(10) The Inquiry accepts the argument that it would be improper to permit exploration for uranium but withhold the right to mine what has been found, at least until a re-determination is made during 1990. It is however satisfied that exploration can be carried out safely within the provisions suggested by the Medical Society of Nova Scotia, and it may be in the public interest to have a better knowledge of the extent of the uranium resources which could be mined. In short the matter of exploration should be reviewed even if the ban on mining is to continue for another period of time, but that 1990 consideration should report the technical and technological changes

that would make it more likely that uranium mining could be carried out with its long-term tailings disposal properly secured. Apart from the tailings issue, the Inquiry clearly finds that the mining of uranium can be carried out if proper precautions are taken for the health of the miners and that the techniques also exist at the milling stage.

PUBLIC RELEASE

(11) The Inquiry recommends that its report including the digest be made public as quickly as possible, and that copies be made available without charge to the presenters. Envelopes for such distribution will be made available to Government before the Inquiry is closed and its staff released.

Nova Scotia

URANIUM INQUIRY
— NOVA SCOTIA

Commissioner:
JUDGE ROBERT J. McCLEAVE

Secretary to the Inquiry
MRS. GLENYS LIVINGSTONE

Co-ordinator to the Inquiry
MR. STANLEY FORGERON

P.O. Box 2467,
Station "M"
Halifax, N.S. B3J 3E4

1724 Granville Street
Tel: 422-6920

SPECIAL THANKS

The Commissioner would like to thank Glenys Livingstone, Secretary to the Inquiry, and Stanley Forgeron, officially listed as Co-ordinator to the Inquiry but also of great assistance in sorting out the thousands of ideas received in the briefs and documentation. Special secretarial services were also provided by the late Pam Evans and, freely, by a co-occupant of the Inquiry offices, Pat Walsh.

Cecile O'Reilly has, in typing of the Report and Digest, provided a professional finish. Brian Condran of the Department of Labour provided recording equipment. Cy Fear of the Department of Public Works provided space, and Myles Rector of the Speaker's Office provided support services.

At many public meetings Nova Scotia hospitality was the order of the day. Hundreds should be thanked for such and other kindnesses.

The strength of the Inquiry was provided by the goodwill and hard work of those who wanted to help Nova Scotia tackle the large problems of the nuclear age in a Nova Scotian way. I think that we succeeded.

And, finally, at dark moments there was the strength given to me by my late wife Ruth even as she fought cancer and by my wife Sylvia and the members of the family circle.

Robert McCleave

APPENDIX

A. ORDER IN COUNCIL

B. NOTICE TO THE PUBLIC

C. REPORT OF ENVIRONMENT CANADA
RE - BANCROFT

D. REPORT OF MINES CANADA
RE - BANCROFT

E. EXTRACT FROM LETTER OF
KILBORN LIMITED OF TORONTO
ON ECONOMIC BENEFITS

Appendix A

Certified to be a true copy of an Order of his Honour the
Lieutenant Governor of Nova Scotia in Council made the
9th day of February A. D. 1982

82-200

WHEREAS it is deemed expedient to cause inquiry to be made into and concerning the public matters hereinafter mentioned in relation to which the Legislature of Nova Scotia may make laws;

AND WHEREAS it is desirable to assess implications relating to the exploitation of uranium or uranium resources in the Province, and to determine measures which should be taken with respect to this resource in the future;

NOW THEREFORE the Lieutenant Governor by and with the advice of the Executive Council of Nova Scotia is pleased to:

1. Appoint Judge Robert J. McCleave of Halifax, in the County of Halifax, to be a Commissioner under the Public Inquiries Act to inquire into and make recommendations to the Governor in Council respecting all aspects of exploration, development, mining, processing, storage, waste management and transportation of uranium in any form, and any substance or activity associated therewith or affected thereby, including, in particular, matters relating to safe environmental procedures in exploration and mining thereof;

2. Direct the said Commissioner to retain the services of such technical, clerical and other personnel, including experts and legal counsel, who in the opinion of the Commissioner are required for the purpose of the inquiry;

3. Authorize the payment to the Commissioner, Secretary and other personnel required in the work of the Commissioner, for necessary disbursements, travel and reasonable living expenses as are required in the discharge of their duties;

4. Order that remuneration, costs and expenses payable or incurred in the course of the inquiry shall be paid out of the Consolidated Fund of the Province;

5. Direct the Commissioner to report to the Executive Council the evidence taken before him, his findings and recommendations, as he sees fit.

The power and authority of the said Commissioner shall extend to and include all matters which he considers relevant to the inquiry prior or subsequent to the date of his appointment.

HFG Stevens

H. F. G. STEVENS, Q.C.,
CLERK OF THE EXECUTIVE COUNCIL.

Appendix B

URANIUM INQUIRY – NOVA SCOTIA

TO: My Fellow Nova Scotians

FROM: Robert McCleave, Commissioner under the Public Inquiries Act

On February 9th, 1982, I was appointed on the advice of the Executive Council of Nova Scotia as a Commissioner under the Public Inquiries Act.

In the official document which came to me, it was set out that "it is desirable to assess implications relating to the exploitation of uranium and uranium resources in the Province, and to determine measures which should be taken with respect to this resource in the future."

I was directed "to inquire into and make recommendations to the Governor-in-Council respecting all aspects of exploration, development, mining, processing, storage, waste management and transportation of uranium in any form, and any substance or activity associated therewith or affected thereby, including, in particular, matters relating to safe environmental procedures in exploration and mining thereof."

Nova Scotians who wish to present their views to me, either personally or through an association or company or some other body having an interest in this matter, are invited to do so. Those outside the province who have some legitimate interest in this province and its peoples will also have an opportunity to have their views considered.

Public hearings will be held throughout Nova Scotia in locations convenient to the public. Final hearings will be held in Halifax.

Private Opinions: If you do not wish to appear at a public meeting and if you do not wish to present your views through some association, then you may write the address below. It would be appreciated if you would use one side of letter sized stationary (8½ inches by 11 inches). Send me your opinions, send me your areas of concern and what you would like the inquiry to answer in its final report, and send me references to articles or books which you think are relevant to the inquiry. Do not however send the articles or books since I will have the resources of several libraries, but if necessary I shall ask you to lend the inquiry your material.

Your letters will be treated on this basis:

Your identity will be kept confidential if you so wish. The issues however raised in your letters will be considered in public. Your names and addresses will be safeguarded from being used by anybody who might want to use them for a mailing list or other method of contact with you. All letters will be answered by myself.

Opinions For Public Meetings: If you wish to appear at a public meeting to present your views, please write to me before March 15, 1982, indicating:

Name, address, telephone number or numbers and times you may be contacted at such, a brief description of each aspect of the inquiry you intend to touch upon, the place you would like to be heard (that is, your community and a public place you think would be suitable), the time of day you would want to be heard, and the days of the week that are suitable and that are not suitable to you. At these public meetings I shall call first the shorter presentations, so please furnish me with the time you expect to use in making your presentation. Interruptions by others will not be considered in calculating the time, but I shall run the meetings strictly by the clock and if you do not finish within the time you have suggested, the balance of your presentation will have to wait until all others have been heard on the first round.

You should address your letters to the postal address indicated below.

Associations, Companies, Societies And Any Entity Representing More Than One Person:

If you wish to present your views without appearing in public meetings, please do so. Such views will be made accessible to the public. Should any of your representation be challenged at a subsequent stage of our proceedings, you will be notified by me, and will have an opportunity to reply.

If you wish to present your views publicly, please contact the inquiry at the address below before March 15, 1982, indicating your interest in so appearing, and presenting a telephone address and the name of a person I may contact. Please indicate the date by which you would expect to have your presentation ready.

General Outline of the Inquiry: I propose to hear the views of every person who wishes to present them during this, the first stage of the inquiry. The public meetings will be advertised in the media serving the area concerned, that is, weekly newspapers and local radio stations.

This notice is carried in the daily newspapers published in Nova Scotia, and in other selected media.

When the first stage is completed, there will be proper public notice of the second and third stages. My wish is that the first stage be used to get views and concerns before me. The second stage will be used for confrontation on any opposing views. The third stage will be used for representations by argument.

If any of the above is unclear do not hesitate to write.

Postal Address

URANIUM INQUIRY
– NOVA SCOTIA
P.O. Box 2467,
Postal Station M,
Halifax, N.S.
B3J 3E4

I look forward to hearing from you.
– Robert McCleave,
Commissioner under the
Public Inquiries Act.

Appendix C

Environment Canada Environnement Canada
Regional Director General Directeur général régional
Atlantic Region Région de l'Atlantique

15th Floor, Queen Square,
45 Alderney Drive,
Dartmouth, N.S.
B2Y 2N6.

October 22, 1984.

4780/25-8

Judge R. McCleave,
Commissioner,
Uranium Enquiry, N.S.
P. O. Box 2467, Station M,
Halifax, N.S.
B3J 3E4.

Dear Sir:

When we met on September 28th, I agreed to provide you with a statement of Environment Canada's opinion of with the decommissioning and closeout procedures being implemented at Madawaska Mines, Bancroft. This facility operated from 1957 until 1964, and from 1976 until July, 1982.

In comparison with the size of the tailings areas near Elliot Lake, Madawaska's are relatively small. They contain a total of approximately 3,500,000 tonnes of tailings in two areas. These tailings are also non-acid generating (pegmatite ore without sulphides) and therefore pose a lesser environmental threat than the tailings at Elliot Lake.

The attached diagram shows that the tailings areas are located between two lakes, Bentley and Bow Lake. These lakes are used for recreation. The historical data (attached) indicate that since 1976 the mine operation did not have a major impact on the nearby surface waters (Bentley Creek, Bow Lake).

In this regard it should be noted that treated effluent was not discharged directly to surface waters but instead to a gravel/sand filter bed, from which the effluent seeped toward Bentley Creek. The same filter bed is used for the decommissioned facility. Surface water flowing across tailings area #1 is directed to this filter bed in a channel.

.../2

The mine suspended operations in July 1982 and in November 1983 a decommissioning and closeout approval was granted by the AECB. This approval extends until November 1988, at which time the industry must apply for approval to abandon the facility. Approval will only be given if review of information collected by the industry during this 5 year period verifies the expected performance of the decommissioning measures.

Since 1982 Madawaska has undertaken several activities toward the decommissioning of the facility. These include:

- contouring of the tailings to eliminate ponding;
- provision of rock cover over tailings;
- construction of a channel to direct surface runoff which drains into the tailing area across the tailings toward the filter bed;
- construction of a stabilization berm for the dam closest to Bentley Lake.

The Environmental Protection Service, Ontario Region, has been monitoring these activities and is generally pleased with the work conducted to date. Because the tailings will not generate acid, potential problems due to the release of contaminated seepage and groundwater are reduced. There are, however, four residual concerns.

During the operating life of the mine, the barium-radium sulfate sludge was pumped to a burial site in the eastern edge of tailings area number 1. This site was selected with a view to maximizing the travel time of any redissolved radionuclides between the disposal site and Bentley Creek. The long term stability of this course of action has not been verified, although it is expected that the rate at which radionuclides could migrate into the creek would be very low.

The tailings dams are low, but their stability over hundreds of years is not known. Erosion of the dams or the tailings could lead to contamination of Bentley Lake or Bentley Creek. As noted above, however, a stabilization berm has been built to support the dam closest to Bentley Lake.

In the short term, the stability of the channel crossing tailings area number one will have to be evaluated. We will want to have a better indication of its long term performance considering such things as potential erosion or deposition of material which could change channel configuration and therefore result in flooding or erosion of tailings.

.../3

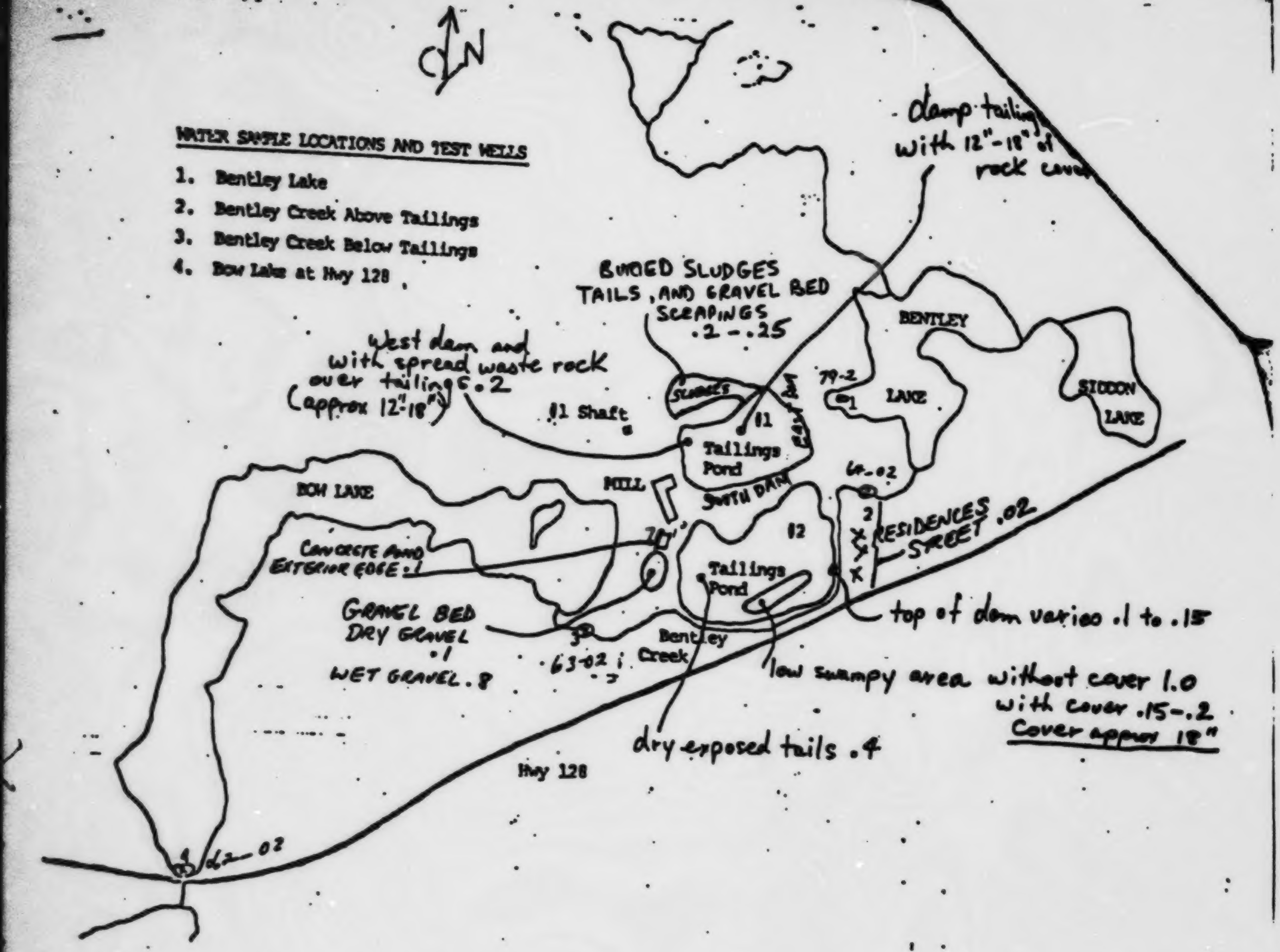
The last concern relates to the long term performance of the filter gravel bed now used to polish surface drainage from tailings area number one. Water quality and quantity data collected over the next few years will be useful in assessing this.

Yours truly,

Clinton J. Edmonds, Ph.D., P.Eng.

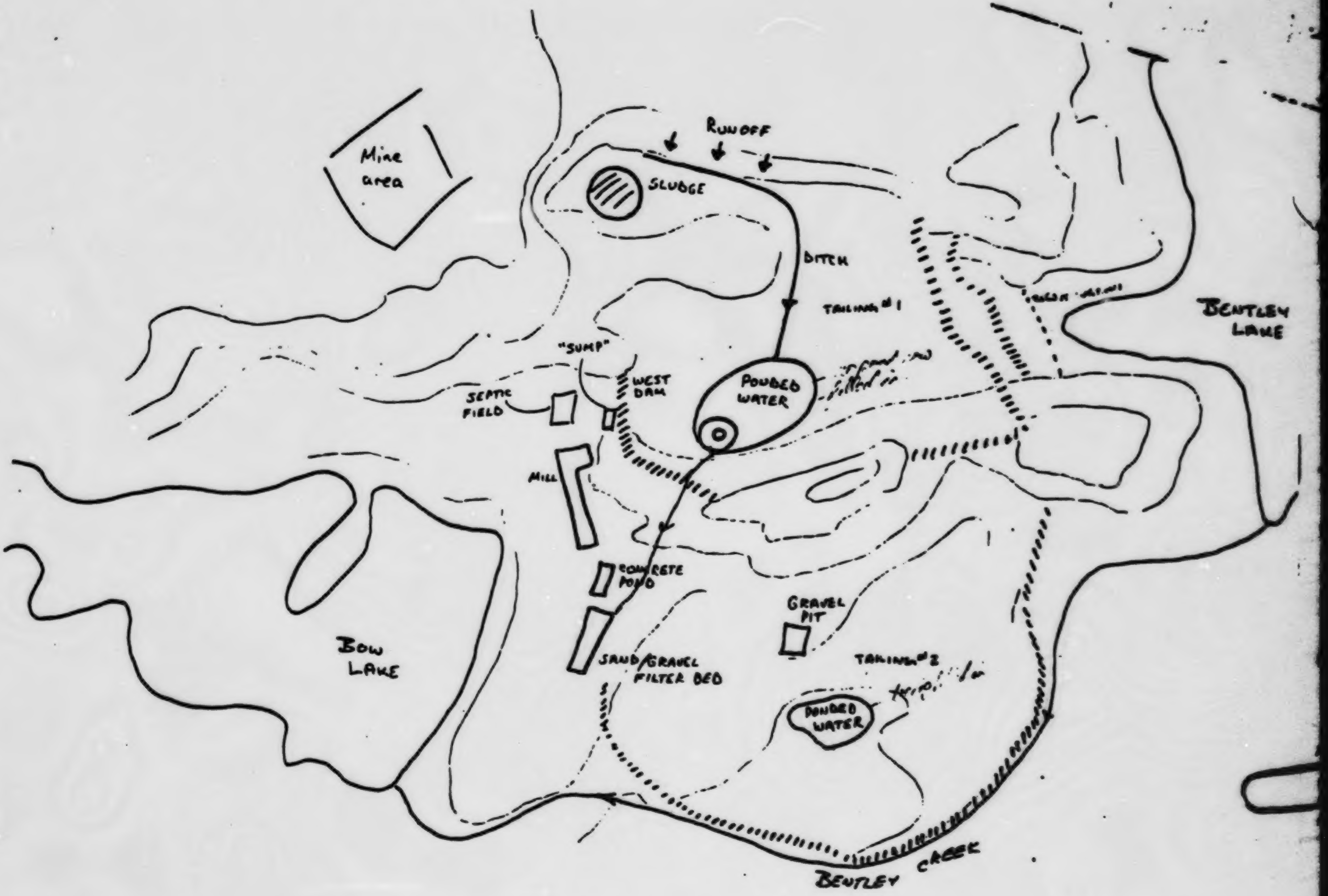
RW/jk

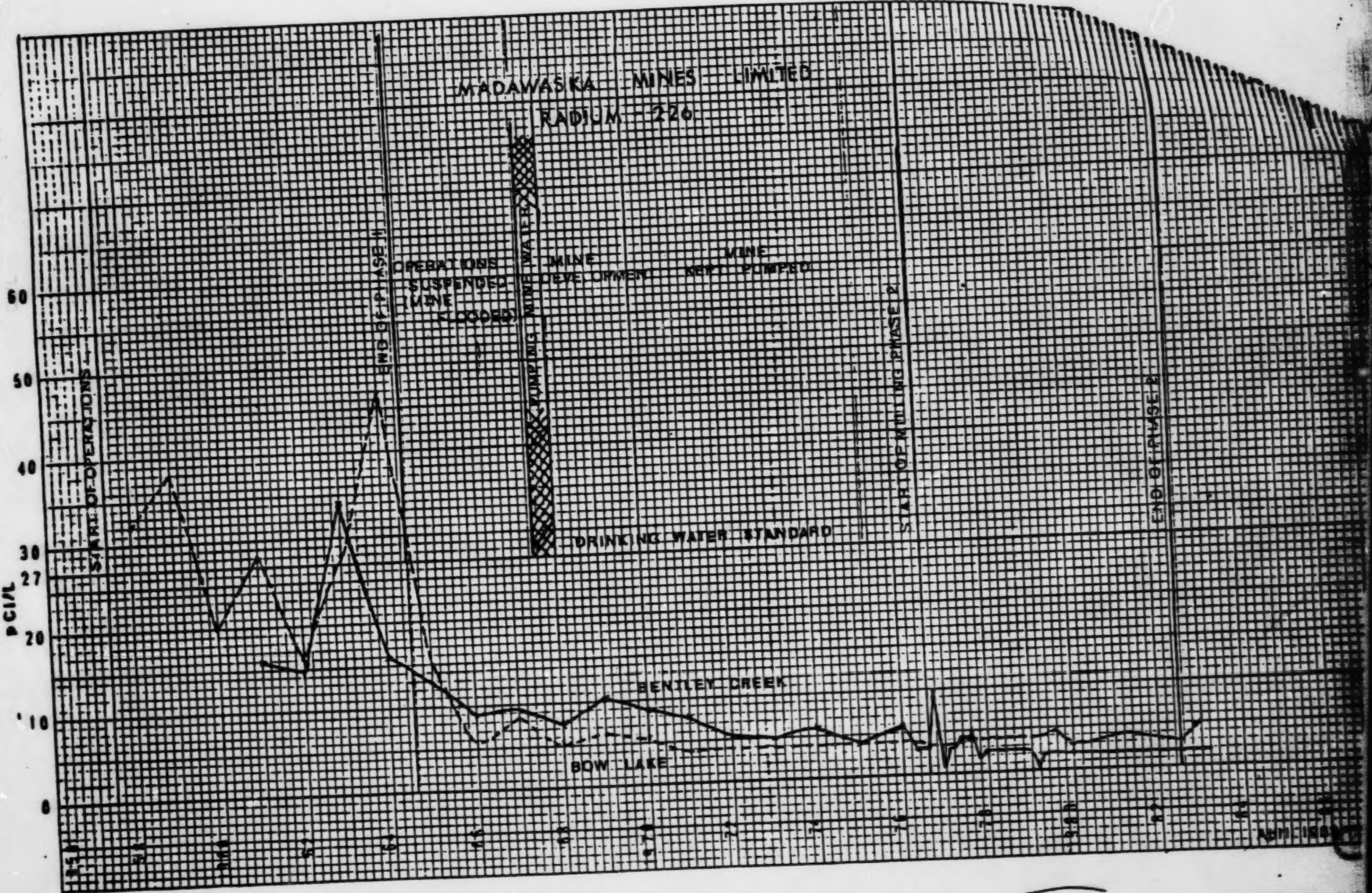
Attachments


N
WATER SAMPLE LOCATIONS AND TEST WELLS
1. Bentley Lake
2. Bentley Creek Above Tailings
3. Bentley Creek Below Tailings
4. Bow Lake at Hwy 128
damp tailings with 12"-18" of rock cover
BURIED SLUDGES TAILS, AND GRAVEL BED SCRAPINGS .2 - .25
West dam and with spread waste rock over tailings .2 (approx 12"-18")
#1 Shaft
SLUDGES
#1
Tailings Pond
BENTLEY LAKE
SIDDON LAKE
79-2
1
64-02
2
RESIDENCES STREET .02
MILL
SOUTH DAM
#2
BOW LAKE
CONCRETE AND EXTERIOR EDGE .1
GRAVEL BED DRY GRAVEL .1 WET GRAVEL .8
3
63-02
Bentley Creek
Tailings Pond
top of dam varies .1 to .15
low swampy area without cover 1.0 with cover .15-.2 Cover approx 18"
dry exposed tails .4
Hwy 128
4
62-02

GAMMA SURVEY

ALL READINGS IN mr/hr. taken ~~at 1 meter~~


Mine area
Runoff
Sludge
Ditch
Tailing #1
"Sump"
West Dam
Septic Field
Ponded Water
in pond now filled in
Mill
Concrete Pond
Gravel Pit
Sand/Gravel Filter Bed
Tailing #2
Ponded Water
Bow Lake
Bentley Lake
Bentley Creek


MADAWASKA MINES LIMITED
RADIUM - 226
pCI/L
0
10
20
27
30
40
50
60
START OF OPERATIONS
END OF PHASE 1
OPERATIONS SUSPENDED (MINE FLOODED)
PUMPING MINE WATER
MINE DEVELOPMENT
MINE KEPT PUMPED
DRINKING WATER STANDARD
START OF MILLING PHASE 2
END OF PHASE 2
BENTLEY CREEK
BOW LAKE
1960
62
64
66
68
1970
72
74
76
78
1980
82
84

Appendix D

Government of Canada   Gouvernement du Canada

MEMORANDUM   NOTE DE SERVICE

File

Project Manager
Measurements

September 5, 1984

Trip to Bancroft - August 28, 1984

On August 28th, 1984, I visited Madawaska Mines Limited at Bancroft accompanied by Judge Robert McCleave (Commissioner for the Nova Scotia Uranium Enquiry). Met with Sam Patterand, Vice-President and Austin Fults, Chief Accountant. There were four other Madawaska staff on site.

The active tailings area has been dewatered and the dam has been breached down to the original soil surface level (see attached plan). The tailings behind the breach has been contoured to give a designed runoff through a narrow ditch. The dam material consists mainly of waste rock with the sand filters and a clay core. This breach material has been used in areas where erosion is likely to occur, such as the contoured area leading to the ditch. Additional material has been taken from the top of the dam for use as surface cover. Any areas which are flat and, therefore, not subject to erosion, have been left as bare tailings. They have not done any surface treatment (i.e. liming or fertilizing) and natural vegetation is already invading the area. They have transplanted some local poplars and aspens and have planted a number of red pine seedlings. They will likely continue this work through the Ministry of Natural Resources. There has been no attempt to prepare the tailings for tree planting. The back end of the tailings area has a bentonite grout curtain. This was installed during operations to control problem seepage to a nearby lake. This is said to work well and there are no longer any concerns of seepage from that area. Of course now it is dewatered there will be little flow from the tailings body. Surface flows should only occur at spring runoff.

... 2

The old (20 years) tailings area is well treed through natural invasion. Most of the trees are scrub trees like aspen, poplar and cherry; however, a number of pines, both white and red, have established themselves. The heights of the trees, including the pines, is probably around 8 to 10 feet. The under story continues to be rather sparse, but I would estimate that there is approximately 40% coverage. This is an improvement over my previous visits. In addition, there seems to be more grass and less of the drought and infertile tolerant species such as strawberries. The local ski club has a trail which runs along the surface of the dam and pass the edge of the tailings. There are houses within a couple of hundred yards of this tailings site.

In general, Madawaska do not intend to do any more remedial action than is absolutely necessary. As the tailings area appears to support vegetation without further treatment, they intend to let natural invasion take care of the under story and the Ministry of Natural Resources reforesting program to add trees.

The radium/barium treatment pond is a concrete pond about 40 feet by 80 feet and about 15 feet deep. The radium/barium sludge is being left in the pond and the whole thing is being buried under a layer of gravel. This means the radium/barium sludge accummulated during operations is spread in a thin layer at the bottom of the concrete pond and buried under 15 to 20 feet of gravel.

As much of the mill as can be salvaged is being cleaned up and sold. When this has been completed, then the remainder will either be dismantled for the wood content and sold or burned. The mill is built of British Columbia fir and the wood is in very good condition. It will depend if the cost of dismantling exceeds the recovery from the sale of the wood. The mine is being sealed up and is in the process of flooding. All leases are still being maintained by Madawaska. Eventually, only Sam Patterand will remain on the payroll.

Judge McCleave also made a number of notes from his perspective. He was interested to see how close human habitation was to the mine, mill and tailings area, as well as evidence of thriving tourism and farming in the area. Fults told us that there was still a significant lumbering industry, mostly for hardwood species. Generally speaking, it is a very rocky area and lends itself only to dairy farming; the ultimate limitation being the amount of available suitable soil. Patterand told us that there were antinuclear groups in the area, but they had been extremely quiet. He had only received one letter asking for information from these groups after the announcement of the shutdown. We were also told that the mine employed 75% of the local labour. They had done this by instituting a training program and found that it worked well. The mine had an employee association which got along extremely well with the management. There were series of incentives

... 3

and bonuses and there appears to have been an open exchange on information including details of operating cost. That close out the cost of producing one pound of uranium was $26. This compares very favourably to the $40 to $55 operating cost of the established Elliot Lake mines (and possibly higher cost at the newly opened mine), but this is nowhere near competitive with the western mines. Patterand was obviously bitter that the Ontario Government didn't give them some of the Hydro contract. He said that 10% of the contract would have kept the mine going and the management was willing to run it break even in order to keep the mine in operation. Fults said the problem of having 75% local people is when the mine closes down there was little else for them to do and most of them were reluctant to leave the area. The only opportunity within the Madawaska group of companies for Fults is a position at Nanisivik in Baffin Island.

Roy John

Att.

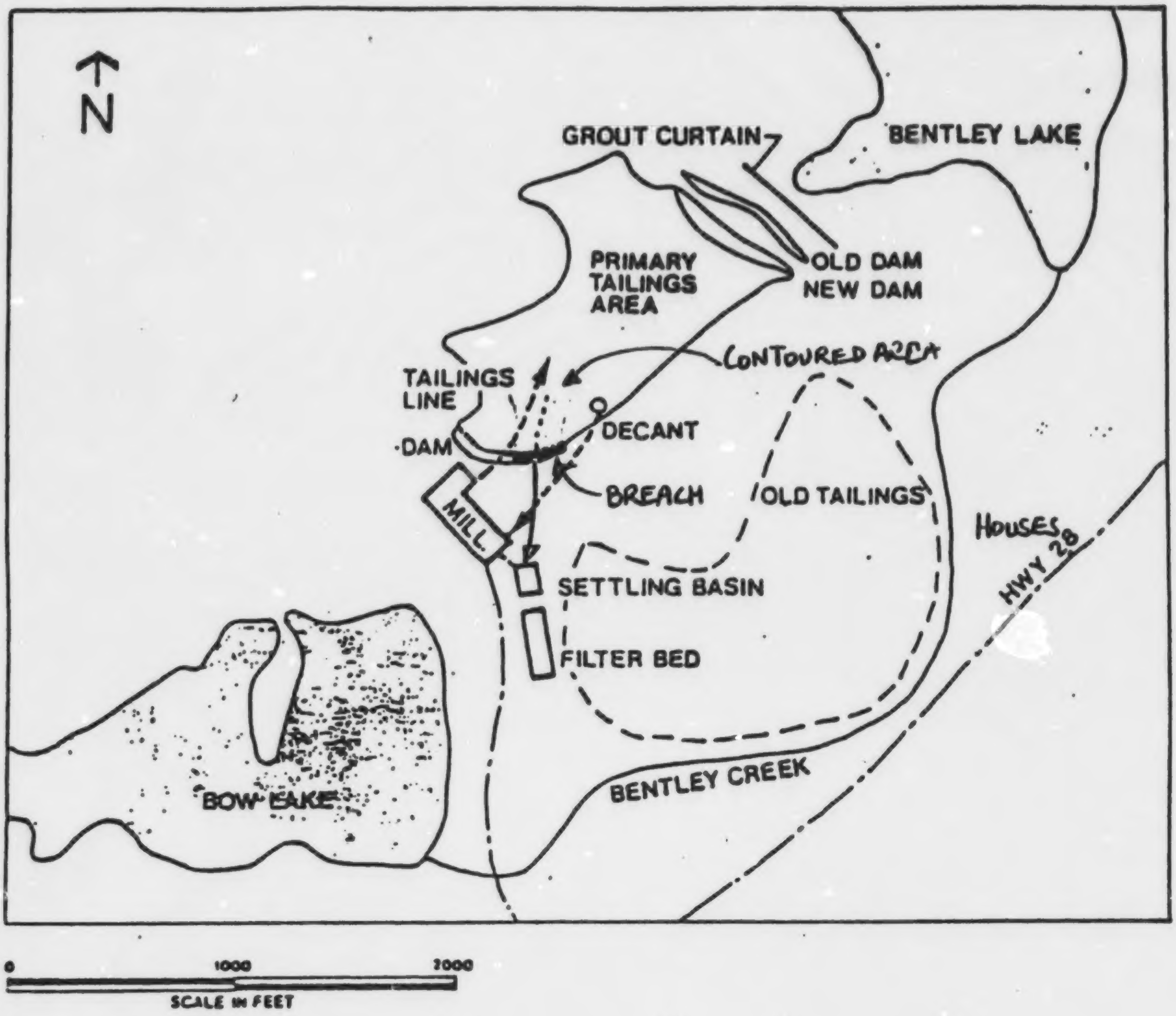

N
GROUT CURTAIN
BENTLEY LAKE
PRIMARY TAILINGS AREA
OLD DAM
NEW DAM
CONTOURED AREA
TAILINGS LINE
DECANT
DAM
BREACH
OLD TAILINGS
MILL
HOUSES
HWY 28
SETTLING BASIN
FILTER BED
BENTLEY CREEK
BOW LAKE
0
1000
2000
SCALE IN FEET

Figure 22

URANIUM TAILINGS MANAGEMENT SYSTEM BANCROFT, ONTARIO : MADAWASKA MINES

(from Kilborn, Beak, 1979)

APPENDIX E.

KILBORN

Kilborn Limited/2200 Lake Shore Boulevard West, Toronto, Canada M8V 1A4. Telex: 06-967531, Tel: 416, 252-5311

July 21st, 1982

Judge Robert McCleave,
Uranium Inquiry - Nova Scotia
P.O. Box 2467, Station M
Halifax, Nova Scotia
B3J 3E4

Reference: Uranium Recovery in Nova Scotia

Dear Sir,

We are writing to you regarding the Nova Scotia uranium inquiry. Kilborn Limited is an employee-owned, Canadian engineering company which was founded in 1947. Since that time we have designed and constructed 13 uranium recovery plants and executed over 100 plant feasibility studies. Also, we have undertaken several studies for Government agencies in which uranium waste management options have been examined. Included in our staff are several persons who worked for uranium mining companies and lived in major Canadian uranium mining communities such as Bancroft, Elliot Lake and Uranium City prior to joining Kilborn.

In addition to uranium experience, Kilborn has carried out extensive work in Nova Scotia including the design and the construction management of Canada Wide Mines, Gays River project, completed the Project Definition Study of the Donkin/Morien project for the Cape Breton Development Corporation, the detailed feasibility study for the tin deposit at East Kemptville and continuing in-plant modifications at the Esso refinery, Dartmouth.

We believe that Kilborn is well qualified to comment on the furtherance of the uranium industry in Nova Scotia. We have considered the impact of a uranium mine-mill complex in Nova Scotia and concluded that the very significant benefits are attainable with an acceptable level of risk.

Cont'd...2

In order to illustrate the potential impact of a uranium recovery facility, we would like to postulate a hypothetical complex processing 2000 tonnes per day of underground ore from which is recovered 2 kg of uranium per tonne (expressed as metal).

1.0 Socio-Economic Effects

Our hypothetical mine-mill complex will offer direct, local, employment to about 400 people. The distribution of employees might be as follows:

Mining (miners, equipment operaters, surveyors, geology)	250
Milling (mill operators, mechanics, laboratory staff)	60
Surface Dept. (equip.operators, mechanics, labourers)	50
Administration (management, purchasing, personnel, health & safety)	40

Salaries and wages paid directly to employees might total about $200,000 per week or in excess of $10,000,000 per year.

At our typical installation, the 400 jobs would probably fall into the following categories:

Job Class	Examples	Number
Skilled	Engineers, Geologists Supervisors, Electricians, Machinists, Instrument Technicians, Welders, Mechanics, Shift Bosses, Secretarial Staff.	200
Semi-skilled	Miners, Mill Operators, Surface Equipment Operators, Apprentices, Clerical Staff.	120
Unskilled	Labourers, Helpers, Trainees	80

It is likely that the operating company will organize a training program in which locally hired people will join the company at the unskilled level and be trained for more responsible or skilled tasks.

In addition to direct employment, our hypothetical mine-mill complex would spin off numerous other job opportunities as a result of the operational requirements. These jobs would be generated in local retail stores, machine shops, supply companies, transportation companies and the like. The impact of $10,000,000 wages into the local area would have obvious beneficial effects on the local recreational, housing and retailing industries.

Cont'd...3

To further illustrate the extent to which indirect employment opportunities would be created by the complex, the possible supply requirements are tabulated below:

Commodity	Value or Quantity required per year
Sulphuric acid	35,000 tonnes
Lime	20,000 tonnes
Grinding Balls	1,000 tonnes
Sodium Chlorate	1,000 tonnes
Flocculants	100 tonnes
Magnesia	500 tonnes
Product drums	3,000 units
Miscellaneous mill operating supplies	$1,000,000
Explosives	1,000 tonnes
Diesel & heating fuels consumed on site	10,000 tonnes
Electrical energy	50,000,000 kWh
Miscellaneous mine operating supplies	$1,000,000

Many of these items could be produced either locally or elsewhere in the province. The transportation requirements are obviously significant.

The foregoing discussion has concerned the impact of the uranium production facility during its operation. However the construction phase is also of importance. This phase, which would probably extend over two years, would require the employment of up to 600 people including equipment operators, construction workers and development miners. Substantial quantities of materials would be required as shown below:

Material	Quantity
Structural Steel	1,500 tonnes
Siding	10,000 sq.m.
Roofing	5,000 sq.m.
Plate work	1,000 tonnes
Piping	25,000 metres
Wire and cable	50,000 metres
Cable tray	1,000 metres
Eletric motors	200

The total capital cost of the recovery complex would be expected to fall between C$70,000,000 and C$120,000,000 depending on the mine and mill design details and the actual location and topography of the complex. A significant portion of the capital cost would be paid out as wages to the construction crews, many of which could be local residents.

Another source of socio-economic benefit to the Province of Nova Scotia and to the Federal government would be the cash flow derived through taxes on personal income, corporate profits, sales and property.

Cont'd...4

DIGEST

OF SUBMISSIONS

TO THE

COMMISSION OF INQUIRY

ON URANIUM

INDEX

TRESPASS, PROSPECTING AND EXPLORATION

NAME	MEETING	PAGE OF DIGEST
Rex Meister	1	1
Mike Keddy	2	2
Judith Steeves	3	10
Mrs. Midnight's Animal Theatre	7	25
Marilyn Manzer	7	26
Ruth Conrad	9	41
Alan Ruffman	10	52
The Mining Society of N.S.	11	60
Kidd Creek Mines	13	71-72
Chamber of Mineral Resources, N.S.	15	105
Environment Canada	18	149
Robert Bays	20	169
Cream Producers of N.S.	24	198
Halifax-Dartmouth District Council	25	213
Community Health Committee N.S. Medical Society	26	217
Michael Crimp	31	246
Janice Firstbrook	33	252
Alexa McDonough, M.L.A.	36	273
Councillor Ira Drysdale	42	309-311
N.S. Dept. of Environment	44	318-319-328
N.S. Dept. of Mines	44	332-335,337-340

HEALTH AND ENVIRONMENT

NAME	MEETING	PAGE OF DIGEST
Mary Lou Jollimore	1	2
Ron Leitold	3	11
Lunenburg County Women's Group	3	11
Hester Lessard	4	13
Donald Burch	1	16
Dr. W. Thurlow	6	18-19
Digby East Fish and Game Association	6	21
Elizabeth Chisholm	6	22
Dr. Michael Brylinsky	8	30
Heather Leigh	8	31
Gwenyth Phillips	8	32
Valley Medical Society	9	34-38
Ruth Conrad	9	42
Pauline Cudmore	9	42
Kings Association to Save the Environment	9	44-46
Halifax West High School	10	47-49
Vincent Calderhead	10	51
The Mining Society of N.S.	11	57
Jane Bishop	12	64
Kidd Creek Mines	13	76-84
Albert W. Perry	14	88
Hattie Perry	14	90
South Shore Environmental Protection Association	14	94-97-98-99

HEALTH AND ENVIRONMENT

NAME	MEETING	PAGE OF DIGEST
The Health Coalition of N.S.	15	108-109
Pictou County Women's Centre	16	110-111
Anne Bishop	16	111
Jane Robertson	16	112
Pictou County Voice of Women	16	113-114
AECB - A.B. Dory	17	115, 120-121 123, 124-125
AECB - W.R. Bush	18	135-141
Environment Canada	18	142, 149
Jacqeline Sanford	19	159-160
George Gore	21	179
N.S. Federation of Labour	22	183
N.S. Department of Health	23	194
Cobequid Women Together	24	198-199
N.S. Federation of Agriculture	24	202
Women's Health Education Network	24	203
Sandra F. Creighton	24	204
Harrietsfield-Williamswood Ratepayers Association	25	211-212
Community Health Committee, N.S. Medical Society	26	216-218
Marilyn Manzer	27	226
Dr. Mark Kazimirski	27	229

HEALTH AND ENVIRONMENT

NAME	MEETING	PAGE OF DIGEST
Gloria Corbett	28	231
Kathleen Tudor	28	232
Dr. Albert Maroun	29	238
Elizabeth May	30	242
Aaron L. Schneider	31	248
Janice Firstbrook	33	254
Dr. David Forshner	33	254-255
Carol Faulice	33	255
Donald Chard	34	261
Dr. A.R. Robertson	37	278
Dr. Robert Sers	37	279
Dr. David R. Myers	39	284-291
Dorien A. Freve	39	295
Elizabeth May	41	301-303
Jenny Orr	42	306
Michele Ryan	43	312
Dr. A. Elnick	43	314
Kathryn Archibald	43	314

LAW AND REGULATIONS

NAME	MEETING	PAGE OF DIGEST
Marilyn Manzer	7	25
Dr. Kenneth MacKinnon	10	52-53
New Brunswick Electric Power Commission	11	55-56
The Mining Society of N.S.	11	59
Hattie Perry	14	91-92
AECB - A.B. Dory	17	119-120-121
Environment Canada	18	143,145-147
Peter Warrian	22	185
Ross Baker	24	206
Community Planning Association	26	221
Janice Firstbrook	33	253
Dr. John Foster	39	284
Dr. Norman Aspin	39	294
Ecology Action Centre		
D. Vanderzwaag	40	296
N.S. Department of Environment	44	317,325

TAILINGS MANAGEMENT

NAME	MEETING	PAGE OF DIGEST
Kidd Creek Mines	13	84-87
South Shore Environmental Protection Association	14	97
Chamber of Mineral Resources N.S.	15	105
The Health Coalition of Nova Scotia	15	108-109
AECB - A.B. Dory	17	117-119,123
AECB - Ken Bragg	17	126-134
Environment Canada	18	150-157
Jacqueline Sanford	19	159
John R. Taylor	20	166
Valerie Wilson	20	166
Ralph D. Torrie	21	171-178
N.S. Federation of Labour	22	184
Dr. Constance MacFarlane	23	193
Prof. Douglas Meggison	35	269
Canadian Nature Federation	35	270
Cream Producers of N.S.	24	201
Ross Baker	24	207
Marilyn Manzer	27	226
Anne Smith	28	233
Harriet Fice	33	256
Dr. Frank N. McDonald	39	291-292
Ronald H. Loucks	41	303-304

TAILINGS MANAGEMENT

NAME	MEETING	PAGE OF DIGEST
Dr. Howard Goldstein	43	313
N.S. Department of Environment	44	320-324,330

MINING - MILLING

NAME	MEETING	PAGE OF DIGEST
Kidd Creek Mines	13	73-76
AECB - A.B. Dory	17	122
Cream Producers of N.S.	24	198
David DeWolfe	27	226
Marilyn Manzer	27	228
N.S. Department of Environment	44	319-329
N.S. Department of Mines	44	332

BAN OF MINERAL EXPLORATION

NAME	MEETING	PAGE OF DIGEST
The Mining Society of Nova Scotia	11	57-58
Kidd Creek Mines	13	72
Chamber of Mineral Resources N.S.	15	106
Voluntary Planning N.S.	15	107

CHANCE DISCOVERIES OF URANIUM

NAME	MEETING	PAGE OF DIGEST
Chamber of Mineral Resources N.S.	15	106

RISK FACTORS

NAME	MEETING	PAGE OF DIGEST
Gordon Cameron	6	20
Patrick J. Smith	8	29
Alan Ruffman	10	52
The Mining Society of N.S.	11	58
Canadian Institute for the Advancement of Women	15	104
AECB - A.B. Dory	17	116-117
Environment Canada	18	138,144
N.S. Department of Health	23	195

WORKER SAFETY AND COMPENSATION

NAME	MEETING	PAGE OF DIGEST
Sylvia Mangalan	19	160-161
N.S. Federation of Labour	22	182
Peter Warrian	22	186
Labour Canada	23	188-189
N.S. Department of Health	23	195-196
Law Union	26	216
N.S. Department of Mines	44	340

MARKETS AND USES FOR URANIUM

NAME	MEETING	PAGE OF DIGEST
Martin Coolen	2	9
Martin Gursky	3	11
Dr. W. Thurlow	6	19
Bear River Board of Trade	6	21
Peggy Hope-Simpson	9	39
New Brunswick Electric Power Commission	11	54-56
The Mining Society of N.S.	11	59
Ralph Loomer	12	62-63
Peter Siemers	12	65-68
Kidd Creek Mines Ltd.	13	70-71
Hattie Perry	14	88
Anne Bishop	16	111
Ralph D. Torrie	21	171
James K. Bell	22	186
Robert Smith	28	235-236
David Quimby	32	251
Alexa McDonough, M.L.A.	36	274
Dr. John Foster	39	283
Susan Holtz	40	298-300

See also Canadian Mineral Survey 1983 by R. Whillans of Energy Mines and Resources and Cluff Lake Inquiry final report at pages 151 and 178.

ETHICAL CONSIDERATIONS

NAME	MEETING	PAGE OF DIGEST
Dr. Emero S. Stiegman	10	47
Donald Weeran	10	49-50
Fred Barrett	20	168
George Perry	21	180
N.S. Federation of Labour	22	185
Archdeacon C.R. Elliott	23	189-190
Bishop James B. Hayes	23	191
Harrietsfield-Williamswood Ratepayers Association	25	211
Halifax Friends Meeting	25	212-213
Oxfam-Canada	26	215
Lynn Nickerson	28	232
Charles Musial	29	241
Geoffrey May	30	244
Jeffrey Gold	31	246
Charles E. Haynes	33	257
N.S. Voice of Women	34	262-264
Frances B. Kelly	42	305
Rev. Peter Mitchell	42	307
Michael Fuller	43	312

MISCELLANEOUS POINTS

Mary Lou Jollimore, page 2 of Digest (re taking of samples from uranium-tainted wells but not reporting the readings to the owner)

Dwight Sanders, page 3 of Digest (fear for Christmas tree market if it were to be known they grew near uranium tailings)

Councillors Stan Melvin and Bruce Preeper of Chester Municipality, page 7 of Digest (a unanimous decision of the Council)

Donald Burch, page 15 of Digest (is there enough water to upport the extraction of uranium?)

Janet Mooney, page 16 of Digest (the possibility of Civil disobedience)

Watson Peck, page 21 of Digest (concern about effects on tourist fishermen)

Michael Marshall, page 50 of Digest (a geographical perspective)

Alan Ruffman, page 51 of Digest (reflections on the vast ages involved)

MISCELLANEOUS POINTS

Dr. C.J. Byrne, page 52 of Digest (comparisons with other factors of the provincial economy)

Virginia Point, page 102 of Digest (the uranium cycle represented WASTE)

Canadian Institute for the Advancement of Women, pages 102-3 (in which was argued that the uranium community used unscientific methods)

Anne Bishop, page 112 of Digest (employment statistics would go up in the area of a uranium mine, making it harder to get unemployment insurance and social assistance)

Heiko Przyrembel, page 164 (the only person to take advantage of Nova Scotia's Old Home Summer provisions of the Inquiry)

Ross Baker, page 208 of Digest (a reasoned explanation for much of the emotion shown to the Inquiry)

Community Planning Association of Canada, pages 219 through 224, (public participation in the decision making process)

James Spencer, pages 236-237 (the drainage system of Western Nova Scotia)

MISCELLANEOUS POINTS

Cape Breton Co-operative Council, pages 239-240 (people losing high wage jobs and unprepared to return to former employment)

Elizabeth May, page 243 (the limits of provincial decision)

Janice Firstbrook, page 252 (some environmentally sensitive areas might not be monitored)

Recreation Association of Nova Scotia, pages 264-265 (as to interaction of uranium development and recreation)

Ian Ball, page 268 (a criminal possibility for annihilation)

Margaret Conrad, page 276 (dreams of becoming a uranium princess)

Beryl A. MacDonald, page 309 (five unrealistic assumptions regarding uranium industry)

PRESENTATIONS OTHER THAN SPEECHES

On behalf of Citizens Organized to Protect the Environment Marie VanderGraff presented slides of Nova Scotia as seen by painters, page 5 of Digest

Susan Hower, page 14, demonstration with a pistol

Marie Siemers and associates presented a play, "Mrs. Midnight's Animal Theatre", page 25

Kathy Aldous made a slide presentation on farm life near Millet Brook, page 27

Matthew Siemers presented a parody of Hamlet's soliloquy, page 28

Pictou County Voice of Women bolstered their brief with a parody on the song, "Farewell to Nova Scotia", page 110

Lesley Choyce presented an editorial written in 1992, page 209

Ronald J. MacEachern, a noted folk singer, presented "Don't you go digging for the dirty ur-an-ium", page 240

PRESENTATIONS OTHER THAN SPEECHES

John May presented some remarks in Gaelic, the only non-English words presented to the Inquiry, page 245

Stephanie May showed a flair for rhymes with the word "uranium" in words and music specially composed for the Inquiry, page 245

Al Rodee presented a parody of the Cat Stevens song, "Father and Son", and photographs of abandoned barrels of PCB'S, page 251

Ronald H. Loucks used the Bayesian Decision Theory ("Decision Tree") approach to oppose uranium development, pages 260-261

Environmental Protection in Cumberland South presented songs by Gordon Campbell and Michael Fuller and Paul Clarke, and a skit by Michael Fuller, and the evening - the last hearing outside Halifax - was topped off by a massive and tasty yellowcake, pages 312-316

MEETING NUMBER ONE - APRIL 2, 1982

NEW ROSS CONSOLIDATED HIGH SCHOOL

1. KENNETH SEABOYER of New Ross - BRIEF

A sawmill craftsman at Ross Farm Museum. He did not think uranium mining could be made safe, and he did think the record of mining companies in cleaning up messes was very poor. *"The experts on the safety of uranium seem to me to be experts only when everything functions properly."*

2. NINA WHITE of New Ross - BRIEF

As a resident of lands adjacent to lands where uranium exploration has taken place, she urged that all uranium exploration and mining be discontinued because the long-term effects were as yet unknown.

3. REX and KARL MEISTER of New Ross - BRIEF
&
4. Lifelong residents and active in farming and lumber. The former was critical of prospectors and drillers running lines without consulting landowners, and if mining took place there would be the problem of tailings. Uranium use in nuclear weapons could wipe out civilization. New Ross was too nice an area to desecrate.

The latter questioned the undesirable sociological effects if New Ross became a mining town. Most in the community depended on forestry *"which had stood the test of time, and sustained New Ross since the day of its settlement."* Uranium was non-renewable and a mining town would eventually become a ghost town. It would be better to use any government resources in, say, a feasibility study on turning waste wood into fuel pellets.

5. TED GATES of New Ross - BRIEF

As a volunteer firefighter, and on behalf of other volunteer firefighters,

9. DWIGHT SANDERS of New Ross - BRIEF

As a Christmas tree grower and exporter, he was part of an established industry which earned a great amount of foreign dollars from a renewable resource. Regulations were very stiff as to the quality of the trees, and he feared the effect if word got out that the trees were grown near uranium tailings. He opposed uranium mining until the demand became urgent and the technology improved.

10. HANS VANDERGRAAF of New Ross - BRIEF

As a civil servant, he dealt with the social and economic aspects. There was a great deal of local respect for the environment, much of the lifestyle was built around the family farm, the Christmas tree industry and the Ross historical farm, and it would be dangerous to introduce a foreign economic element - could it be absorbed? Although uranium provided cheaper energy than fossil fuels, when you took into account the cost of building reactors and repairs, their moth-balling and entombment, uranium was likely the most expensive energy produced to date. Uranium mining would alter the lifestyle of communities and would require extra services, then the mine would die. The beauty of the countryside would be destroyed. As for the disposal of tailings, no waste disposal system has lasted the 40 years of the industry without failure.

11. LAWRENCE WELNER of New Ross - BRIEF

An electrician with a wife and two children, he was concerned about the pollution from open pits. Uranium mining should not take place because it has not been scientifically proved *"without a shadow of a doubt that it can and will be done safely."*

he had reservations about entering uranium mine areas in the case of emergency calls whether fire or other.

6. MARY LOU JOLLIMORE of New Ross - BRIEF

A mother of three children and a housewife, she felt that there should be more research to reassure everyone that "*a) disposal of wastes would be safe, b) our environment would not suffer from the mining, and c) we or future generations would not be plagued by health hazards as a result of uranium mining.*" Residents could live with uranium underground even though it showed up in their well water but to bring it above ground was another matter. If there were no intent to mine then there should be no need for exploration to find it. She said that a mining company took a sample from her uranium-tainted well but never advised as to its findings.

7. MIKE KEDDY of New Ross - BRIEF

As a Christmas tree farmer, he pointed out the high percentage of privately owned woodland in the area which could not be exceeded elsewhere in Nova Scotia. He gave three examples of what he considered to be abuse by E & B Exploration Limited involving Clayton Ramsay, Chester Keddy and Don Reeves, the main points being lack of proper compensation and damage to land and brooks by cutting prime trees and roads. There was not enough advice by government as to the rights of the public.

8. JOHN COLLINS of New Ross - BRIEF

As an employee of the Masonite Hardboard plant, he recalled proposals by its predecessor Anil to dispose of waste which did not work. Basins lined with clay to hold uranium tailings would not work.

12. EUGENE ELLIOTT of New Ross - BRIEF

As a lifelong resident with the exception of a few school years, he believed only eight percent of the employees of a uranium mine are hired from the local area. He doubted if employment benefits would outweigh the health risk, its greatest threat being from low level ionizing radiation. People also tended to shy away from mining areas.

13. SCHOOL TRUSTEES of New Ross - BRIEF

On their behalf SALLY WALKER advised that they were concerned over the drinking water at the school and they were told by the Provincial Department of Health that the school water's uranium content was above an acceptable level. Accordingly the school imported water.

14. REV. GORDON NEISH of New Ross - BRIEF

As a rector of the Anglican parish, he questioned the overall economic benefits of uranium mining because the government could be faced with a reclamation bill far in excess of the short term benefits. As for the apparent silence of the majority he hoped it would not be interpreted as support for uranium mining or indifference.

15. MRS. BEATRICE LARDER of New Ross - SKETCHES

As a mother of five she presented two charts demonstrating two questions that she felt came to mind when considering an economic future based on uranium mining - (1) WHAT FOR? and (2) FOR WHAT?

16. GERALD M. KEDDY of New Ross - BRIEF

He was concerned with the *"magnitude of radioactive waste from the mining and smelting process"*, said that there were enough mining contracts to

ensure our domestic needs for at least 20 years, thought that provincial controls and penalties might not be adequate in light of the Yava mine experience at Salmon River, Cape Breton, and argued that it was not worth having a mine for 20 years leaving a disposal problem for 100,000 years.

17. FERN HILTZ of New Ross - BRIEF

As secretary of the New Ross Farmer's Association, he said the medical service in the area has been a concern to the local farmers for many years. Three Chester doctors came to New Ross for one-half day each. *"We do not need the extra medical problems that are created by mining."*

18. CITIZENS ORGANIZED TO PROTECT THE ENVIRONMENT (COPE) - SLIDES

An imaginative presentation by the Nova Scotia artist, MARIE VANDERGRAAF, presented the beauty of outdoors Nova Scotia as seen by its painters and raised health-environmental questions. *"If you mine uranium our province will no longer be seen to be beautiful."* She also said that the people of New Ross experience approximately five times the usual background radiation level. *"There is no known level at which* (radium and radon gas) *can be proven to be safe."* Had exploration for uranium in the vicinity increased uranium levels in the New Ross water supply?

19. GEORGE WHITE of New Ross - BRIEF

He argued it was better to prevent crime than to have to punish for it, and said uranium mining *"leaves future generations with a burden which is dangerous and totally unwarranted."*

[NOTE: The Commission returned to the New Ross area to visit sites of uranium exploration and to investigate instances of damage by such.]

MEETING NUMBER TWO - APRIL 14, 1982

CHESTER MUNICIPAL HIGH SCHOOL

20. CHESTER HIGH SCHOOL STUDENT GOVERNMENT - ORAL PRESENTATIONS

SUSAN TUCK introduced several students. First was KIRBY KEDDY who dealt with the problems of waste disposal and who thought that uranium mining could be likened to selling your house to go to Las Vegas where you might win a bit and lose a lot. DORA ASSAFF dealt with health hazards and pictured cancer epidemics. *"Every breath that you take if we have uranium mining in this area might be your last."* WILLIAM SOVIE reported the results of a survey in the school on nuclear issues. Miss TUCK said the majority of students oppose mining within 50 kilometres of their homes and the disposal of tailings would affect forestry, fishing and tourism. Those students who favoured uranium mining thought it would help the economy. She herself thought *"my generation will be blamed if we go to uranium development."*

21. H. SHIRLEY FOWKE - BRIEF

Nova Scotia is a narrow province and *"uranium mining in pockets up and down the province could cause general and potentially catastrophic pollution."* She criticized permission to explore for uranium in the Pockwock water shed. She suggested that uranium mining companies be required to post a $500,000,000 bond before commencing work. Uranium should be left in the ground until it was needed and could be safely dealt with.

22. K. DOUGLASS ROSS of R.R. #1, Chester Basin - BRIEF

Nova Scotia may be a "have not province" but *"this same physical environment gives us contentment and attracts visitors."* He likened uranium mining companies to the operators of Yava lead mines in Cape Breton and said they were *"dangerous litter-bugs."*

23. PETER F. SMITH - BRIEF

He was concerned about the health hazards of low level radiation. There was a time lag between exposure and effects and therefore *"the damage done by low level radiation near a mine site would probably not become obvious until after the mine has closed."* He also touched on the uses of uranium in nuclear reactors, and the balancing of benefits - jobs not more than several hundred as opposed to severe environmental problems.

24. COUNCILLORS STAN MELVIN and BRUCE PREEPER of the Municipality of Chester - BRIEF

The former related the concern of homeowners because of the predominance of shallow wells, and the worry of the tourist industry. The latter said that every councillor had been asked for an opinion and it was a unanimous decision *"to request the Government of Nova Scotia to continue for the forseeable future the moratorium on uranium and associated mineral exploration and mining."*

25. KATHY WELLS - BRIEF

As a mother she appeared because, while she had never spoken out before on any issue publicly, she was *"scared to death"*. Her concerns were the 85% radioactive material left when uranium is mined, the scarring of the countryside for several miles around, the risk of cancer, the abundance of uranium elsewhere, the constant radiation from wastes for thousands of years. *"Nova Scotia offers so much in terms of beautiful surroundings, an uncluttered countryside and an easy casual lifestyle"* and should not be placed in jeopardy.

26. JEROME MORGAN of Chester - BRIEF

The unspoiled environment of Nova Scotia was advertised in many other areas, particularly in the urban and industrial complex of the North-Eastern United States. He believed that the Minister of Tourism had forecast that tourism will be the biggest industry in North America by 2000 A.D. *"I doubt that uranium mining figures in the Department of Tourism's plans for the South Shore."* Under good economic planning, priority should be given to a relatively stable long-term industry and only in cases such as an Alberta oil type situation should an exception be made. He did not think the uranium industry would produce a Chester Heritage Fund.

27. TRUDI CURLEY of Chester - BRIEF

There were too many unanswered questions and too many failures in the past decade in the area of uranium and nuclear energy. *"It's like someone else's garbage - I don't know what's in it but I don't want it dumped on my lawn."*

28. EDNA BREMNER of Chester - STATEMENT

This was the first time that she had spoken at a public meeting. She was strongly opposed to uranium mining as a landowner, taxpayer, mother of two and lifelong resident. There was a potential health hazard - "What guarantees do we have from government that we will not be affected?" - and Canada has sufficient uranium to suit its needs for the next 20 years.

29. GRADE XII HISTORY STUDENTS of Chester High School - ORAL PRESENTATIONS

Six students spoke of their concerns. BEVERLY COOLEN did not think that there was sufficient public awareness. BETHANY KEDDY dealt with environmental problems concerning uranium tailings and *"Nuclear Madness which is greater than any health hazard from a plague."* TROY LANGILLE spoke of carcinogenic effects. *"If I should marry I would want healthy children."* SHERRY RHYNO was concerned about the threat to the agricultural industry through the ecological food chain. PHILIP STEVENS spoke of the tourism industry. Elliot Lake, Ontario, was a *"treeless rock pile. Imagine our area looking like that."* And MARTIN COOLEN dealt with the economics of an uranium mine which would require considerable capital on which there would have to be a return although world prices had fluctuated from $4 to $42 per pound.

MEETING NUMBER THREE - APRIL 20, 1982

LIBRARY, BRIDGEWATER HIGH SCHOOL

30. ROBERT FINCK - BRIEF

He considered that the uranium industry was tottering on the edge of bankruptcy, yet was being supported by the Canadian government through bargain sales to anti-democratic countries. A uranium mine in Nova Scotia would create a negative perception of the area. He also argued that *"technology has advanced so rapidly that it has left our moral and legal codes far behind"* and asked whether we should take a short-term benefit which would bind twenty thousand generations.

31. JUDITH STEEVES - BRIEF

A high school teacher who also operates a 50 acre farm, she was critical of companies who could intimidate the private landowner. She said that property values would go down if uranium mining were permitted. And even uranium experts admitted that the technology is currently not available to provide permanent disposal of uranium tailings with no need for perpetual human management. The water system for Elliott Lake, Ontario, which contained no living matter was as long as Western Nova Scotia was wide, and she urged a thorough study of ground water flows to predict areas where wells and municipal drinking water supplies might be contaminated.

32. RON LEITOLD of New Germany - BRIEF

A Manitoban who has lived in Nova Scotia for 13 years, he enjoys *"the friendly people, the unique sense of place and tradition these people possess, and most of all the variety of lifestyles they practice."*

Yet Nova Scotia was small in size and the effects of uranium mining could not be tucked away into a remote corner as it could in Ontario or Saskatchewan. The Commission would hear much about the economic, social, environmental and public safety aspects but he thought more than these uranium mining is a moral issue. For example, *"how much hazard to our life and health should we be prepared to accept in pursuit of any source of energy?"* An unbelievable quantity of radioactive wastes was created in uranium mining *"that makes it nearly impossible to isolate them from the environment."* He elaborated with many points about tailings disposal, the principal one being that there could be no walk-away disposal given the current state of technology. Mr. Leitold's brief was buttressed by 20 references.

[NOTE: Mr. Leitold was a familiar figure as the Inquiry held 41 more meetings. He attended most of them.]

33. MARTIN GURSKY of New Germany - BRIEF

He opposed the nuclear industry since he believed that the peaceful production of power from nuclear plants could never be separated from the proliferation of nuclear weapons. He quoted Albert Einstein that *"the splitting of the atom has changed everything except our modes of thinking and thus we drift towards unparalleled catastrophe."* He also argued that since 1980 there has been a steady decline in the world price of uranium and new mining ventures "especially for low grade ore" would be uneconomical. Mr. Gursky's brief has 15 references.

34. LUNENBURG COUNTY WOMEN'S GROUP - BRIEF AND CHARTS

On behalf of its 50 members, MURIEL MAYBEE presented a series of charts and a table in an imaginative way. The mining of uranium would mean that uranium products were exposed to the air, to water and to the soil, and would work their way into the food chain. *"The uranium mine doesn't have to be next door to affect me."* Nobody had been able to contain tailings 100%. Aldo Leopold's concept of a land ethic to guide our behaviour is needed. (A Sand County Almanac, Oxford University Press, pps. 217-220) The Inquiry would have the difficult task of having to weigh the arguments pro and con. What a person or group has to gain or lose should be taken into consideration. This group asked for a long term moratorium.

MEETING NUMBER FOUR - APRIL 27, 1982

LIVERPOOL REGIONAL HIGH SCHOOL

35. WILLIAM ZIMMERMAN of Great Island - BRIEF

As an engineer active in the energy field, he was often asked his assessment of nuclear power. *"It is impossible to rationally discuss environmental impacts because of the time scale involved. The residue of our brief involvement with nuclear fission will continue to pose a threat to the environment for more years than humanity has been aware of its humanity."* He felt that the final decision would be moral, not technical. Probably the issue itself was beyond facts. Appends seven references.

36. HESTER LESSARD on behalf of UNITED CHURCH WOMEN OF MILL VILLAGE, LADIES' AUXILIARY OF PORT MEDWAY FIRE DEPARTMENT, and SOUTH SHORE ENVIRONMENTAL PROTECTION ASSOCIATION (QUEEN'S COUNTY CHAPTER) - BRIEF

She concentrated on the hazards to human health. As for the occupational hazards she questioned the validity of international safety standards. Mining companies would be reluctant *"to institute expensive safety precautions"* and radiation was both invisible and took time to manifest its effects on the health of miners. As for public health her brief, as did so many others, referred to the large amounts of radioactive wastes resulting from uranium mining which could never be re-enclosed in solid ore. The brief contains eight footnotes to Part One on occupational health and eight to Part Two on public health. In a conclusion in which benefits and risks are contrasted (supported by four footnotes) she saw perhaps 200 employed for 15-20 years as opposed to tens of thousands of years of radiological disease *"being born by a comparatively small population."*

37. SUSAN HOWER of Great Island - BRIEF & DEMONSTRATION

She described herself as one without a traditional stake in the future since she was a *"genetic dead end by choice"* but she came forward for one reason: conscience. Since only three were presenting briefs, she wondered where the community leaders were. A public inquiry was not the way to deal with this issue; there should have been a comprehensive program of public education on uranium and nuclear power *"followed by an appropriate period of time and a functioning political system which assumes an approachable Government."* But without a knowledgeable electorate, life was one monstrous game of Russian Roulette. (She produced a type of barrelled pistol and drew a black mesh over her face and performed a mock suicide). Her brief contains five references.

MEETING NUMBER FIVE - APRIL 30, 1982

CHESTER MUNICIPAL HIGH SCHOOL

38. DONALD BURCH of Chester Basin - BRIEF

A chemical technician who has lived in Nova Scotia for 7 years, he had been employed as a process technologist in Sudbury dealing with the purifying of base metals. In his experience, in a copper or nickel mine water can be filtered and removed from a tailings pond. In his opinion, *"there is no way the water should be allowed to leave the site"* of a uranium tailings pond. There was also a vast amount of dust which on a uranium tailings pond would spread radioactive elements through the winds. He also dealt with the effect upon the water table - as example, 500 - 700 gallons of water in B.C. to produce about 20 pounds of uranium from one ton of ore. In his area it was touch and go whether his well could provide enough domestic water in September. And there was danger that contaminated water could leak back into the system. He recommended (1) that an environmental impact study be carried out by the Department of the Environment of Nova Scotia to determine whether our water table could support uranium mining and (2) that the Department of Health should gather data re the water tables *"to insure that the already high counts of uranium don't get higher"* while the moratorium is continued.

39. ERIN GORE of Chester - BRIEF

Most of those opposing uranium mining were not active environmentalists; she and her husband had chosen to raise four children (three adopted) in a *"healthful, nurturing environment that is now ten kilometres from a proposed uranium mine."* The health hazards were too great to offset whatever economic advantages such mining would leave for Nova Scotia.

"We will not stop fighting because we know that if we do not have uranium mining and we're wrong, we will not have lost much; but if we do have mining and we're wrong, we could lose everything." One could not accept as objective the statements regarding safety from scientists employed in the nuclear industry.

40. KATHERINE M. MACPHERSON of Chester Basin - BRIEF

She dealt with the contamination of ground-water by uranium mill tailings disposal sites. In Central and Southwestern Nova Scotia there is a thin glacial overburden on dense fractured rocks made up largely of granite, quartzite and slates. There was 40-50 inches of precipitation annually, and 15-20% was transmitted through rocks. *"A typical chemical analysis of a uranium tailings effluent provided by Sheppard and Cherry (1980) illustrates the high levels of heavy metals and radionuclides that could affect the ground-water"* - the reference to a paper presented at a Colorado State University symposium. There are three other references pertaining to the Departments of Health and the Environment.

41. JANET MOONEY of Chester - BRIEF

She felt honoured *"to be participating in this grassroots democratic experience."* Nova Scotia uranium would be used in the nuclear industry, whose "major job is the production of the plutonium needed to make any type of nuclear weapon." Halifax would be a target in nuclear war, and she presented a forecast of the dropping of one 10-megaton bomb on its City Hall. After spending seven months talking to people all over the municipality she said there would be civil disobedience if such a step were necessary to stop uranium mining.

42. MARY LOU DOREY - STATEMENT

As a concerned mother of two, she wrote that the mining of uranium was not safe or presently necessary, she was not convinced that radioactive waste could be disposed of safely, and would be a burden to clean up the environment.

43. CITIZENS AGAINST URANIUM MINING - BRIEFS

The presentation at this meeting will be dealt with subsequently.

MEETING NUMBER SIX - MAY 6, 1982

I.O.O.F. HALL, BEAR RIVER

44. Doctor W. THURLOW of Digby - BRIEF

There are several reasons why this presentation must be considered as one of the major presentations on the health aspects of uranium mining. As an intern and as a surgical resident for three years, he treated miners of the fluorspar mine in St. Laurence, Newfoundland, who were dying of cancer. The mine did not have a significant excess of uranium that he was aware of, but it did have an area of high radon gas concentration which affected a generation of miners before it was detected and handled with proper ventilation. From this and from his studies *"I have come to the conclusion that the legally allowed standards of radiation exposure in both occupationally and non-occupationally exposed populations is too high."*

Dr. Thurlow noted that in medicine one is required to keep radioactive substances for a full 10 half-life periods. The substance then disintegrates to the point where the exposure levels would be essentially the same as background radiation. *"The safety rules to be applied to the uranium mining industry should be no less stringent than those applied to the medical profession."* In uranium mining the major radioactive left over is thorium 230 with a half-life of 77,000 years - a tailings pile would have to be kept in safe storage 770,000 years.

His brief argued that the uranium is not *"going to walk away if we leave it alone."* It was likely that a safe method of handling radioactive wastes would be discovered, but not for at least 40-50 years. He pointed out *"under current atomic theory, nuclear fission must lead to radioactive waste products while nuclear fusion reactions could theoretically be run* *through to completion resulting in stable, harmless helium."* One should consider the continuation of research in fusion reactors for energy. Dr. Thurlow made 13 recommendations. He would divide the assignment of responsibility among the Department of Mines for safety of mining (1), the Department of Health for setting and monitoring standards for radiation exposure (2) and the Department of Environment for setting standards for base metal disposal and base metal concentration and radiation.(3) The Department of Health should form a committee which would include doctors in private practise and citizens and provincial employees to set standards (4) and mining companies would have to guarantee that they could follow such standards (5). All tailings would have to be stored for 770,000 years *"or until a major ice age glacier has passed over the area."* (6) Public hearings should be held (7), the Government should consider refusing mining of uranium until a use for such is found in Nova Scotia (8), milling and processing operations should not be permitted in valleys where people live and ideally should be placed on the Atlantic Coast where the coastline faces East with long stretches of ocean beyond (9), the Department of Health should test all water supplies for radioactivity within 10 miles of a proposed exploration/mining site (10), mining companies should be required to post "a large bond" (11), the Department of Health should set a maximum permissible level for radiation in drinking water and should ban such use above that level (12) and the Workers Compensation Board should be prepared to pay full benefits to miners who contract lung cancer and to their families after the miner has died (13).

[NOTE: The student unfamiliar with the abc's of radiation will find an excellent analysis in the first four pages. Dr. Thurlow in remarks made in addition to his brief told of the efforts of dying miners to win compensation cases so that their wives and children could be provided for. R.J. McC.]

45. GORDON CAMERON of Weymouth - BRIEF

As it turned out, Mr. Cameron was the oldest person to appear before the Inquiry (he was born in 1901). This lively octogenarian had spent the greater part of his life in the radiation field - as a chemist refining radium, 1923 to 1926, at the Rockefeller Institute for Medical Research doing X-ray diffraction studies, 1926 to 1930, as a radon processing plant operator in New York City Hospitals, 1930 to 1937, and until his retirement in 1965 as a calibrator of X-ray equipment and surveyor of protection on Cobalt - 60 installations. He had undergone many tests from 1948 on, and the latest report was *"no change due to radium and no abnormalities in the chest or long bones."* He thought people were too alarmed regarding radioactivity, its worst source being medical X-rays in hospital. The public accepted the risk of 84 highway deaths in Canada every five days. It was his opinion that if we do not have nuclear power in the near future we'll be subjected to brown outs or black outs, and *"we shall have to accept the risks."* A pellet of uranium costing $7 has the energy of three barrels of oil costing $84 or one ton of coal at $29 (1980 U.S. dollars).

46. BEAR RIVER BOARD OF TRADE - BRIEF

William Hamilton was spokesman for this organization, one of the oldest in Canada. There was particular concern about the heavy run-off of water *("the annual rainfall is twice that which the soil can utilize")* and the possibilities of contamination. As for radioactive waste, *"with present day technology, no effective and final solutions are available."* Nova Scotia was a small province and mining could squeeze wildlife, hunting, fishing and camping. The government of Nova Scotia should not invest in uranium exploration and mining. Uranium exploration or mining should be prohibited until: (1) proven beneficial provincially and locally, (2) health hazards from radioactive wastes contained and health hazards eliminated, and (3) no increase in taxes now or in the future is assured. Appropriate legislation and regulations should be put into effect as soon as possible.

47. WATSON A. PECK - ORAL PRESENTATION

Mr. Peck is one of the best known guides in Western Nova Scotia. He warned about the effects of exploration and mining. *"I don't think I could promise a successful fishing trip to a tourist."* He asked whether Nova Scotia wanted to be a part of the nuclear business.

48. DIGBY EAST FISH & GAME ASSOCIATION - BRIEF

The Association was concerned particularly about the fresh water fishery, and while the same circumstances might not exist here as at Serpent River, Ontario, *"It is conceivable that relatively small spills would have a great effect."* The acids used to process uranium could be very harmful if the acidic wastes found their way into the waterways. The streams were small. Also, the presenters, DON BALSER and HUBERT VRUM, said that most finds in Digby County have been made in uninhabited and inaccessible areas which *"hold the breeding nucleus of many species of game animals and fur bearers."* There was danger from the flow of contamination from headwaters on down.

(A map showed the common source of the Mersey, Sissiboo, Shelburne, Roseway and Tusket watersheds around Moosehead Lake).

49. ELIZABETH CHISHOLM of Bear River - BRIEF

She dealt with the contamination of groundwater from uranium exploration and mining. *"The central highland of Nova Scotia acts as a huge sponge, storing excess water in countless lakes and bogs."* She posed the question, arising from the radiation hazards associated with storing uranium tailings, *"in cases where the operation may be hazardous to a number of people, should the promoter be required to prove safety?"*

From the viewpoint of a farmer, she was concerned about any loss of agricultural land since the province produced only one third of its food requirements. If money put into encouraging uranium exploration and mining and this Inquiry were put into controlling erosion and draining saturated land, farmers could produce more food and generate jobs of a permanent nature.

50. CHARLES A COUPER and MARJORIE F. COUPER - BRIEF
&
51. Nova Scotia depended on the support given by its visitors and Bear River had made *"a considerable effort to improve its village and waterfront and expound its unique heritage abroad."*

Any benefit as the source of uranium would be outweighed by the destruction of its image as a pastoral vacation haven. Mining companies had some ground for their argument that there was public ignorances with respect to uranium mining hazards, but the Coupers said suspicion had likely been planted by companies who have been less than candid about their operations. Recent earthquakes in New Brunswick had shaken their house and wrenched a stove pipe from the chimney and he was concerned about the New Brunswick nuclear station less than 40 miles away. There was the moral implication of the ultimate use of uranium *"to place human life on the endangered species list."* The Coupers asked for a general moratorium.

52. DIGBY REGIONAL HIGH SCHOOL - SIGNED STATEMENT

Seventy-six Grade X to Grade XII students from more than one dozen communities signed a statement of opposition. One of the three pages of signatures said *"uranium mining is very dangerous. Therefore we are opposed to this unless safety measures are being exercised at these mining sites."*

Two names were signed and then scratched through on the page containing the above statement.

53. & 54. & 55. ARMISTA, DONALD and MARLENE FROTHINGER - READINGS

ARMISTA is probably the youngest person to appear before the Inquiry, an hour or so after GORDON H. CAMERON had become the oldest. Under 12 years of age and fitting everybody's idea of what Heidi would look like (after all, Bear River boasts that it is the Switzerland of Nova Scotia) Miss Frothinger delivered a speech she had earlier delivered for Four-H. It was mainly based on the Three Mile Island nuclear reactor disaster. Her father, DONALD FROTHINGER, read into the record a magazine article dealing with pollution in Cape Breton from a lead mine. Her mother and his wife, MARLENE FROTHINGER, read a considerable extract from a three-part article in the New Yorker by Jonathan Schell, now published by Knopf as "The Fate of the Earth." [Its call for a new code of life in a nuclear age may well turn out to be a "crucial event in the history of human thought," as its publisher claims. Obviously the articles had a great effect upon Mrs. Frothinger who had typed dozens of pages and who broke down during the reading. R.J. McC.]

56. FRANK TURNER - OFF THE CUFF PRESENTATION

As an electronics engineer, he was concerned about disposal of wastes from a nuclear reactor and because of the measure of risk did not think Nova Scotians should commit themselves to the use of such a source of energy. Besides *"we are wasteful in our consumption of energy"* and can use our present sources in a better manner.

MEETING NUMBER SEVEN - MAY 12, 1982

CENTRE BURLINGTON HALL

57. MURIEL SIEMERS, PAT GOULD-THORPE, BETH TAYLOR, LOUISE VELDHUISEN, KATHY ALDOUS of Centre Burlington area with several farm animals - PLAY

Undoubtedly the most imaginative presentation to the Inquiry, this was a "one performance only" of "Mrs. Midnight's Animal Theatre". There was a prologue in verse by Muriel Siemers concluding:

"We crave indulgence for our play
As we let our animals speak today."

The cast included a chicken, lamb, piglet and kid. Uranium entered their lives when a prospecting helicopter was heard offstage. Piglet was the knowledgeable one who told the others that uranium could not be eaten or drunk, and human beings used it for nuclear power and nuclear bombs. Lamb led in a chorus which included:

"We're not really half so dumb,
We know we don't need ura-nium."

The audience joined in some of the songs. There were special effects by Mesdames Mackenzie and Thomas and Rev. Robert M. Johnson.

[NOTE: Such are the risks of animal life that the meeting was scheduled before some of the animals grew too large to be manageable, and since then some have become part of the good eating in that area. R.J. McC.]

58. PAT GOULD-THORPE - STATEMENT

As the President of the Nova Scotia Dairy Goat Association (she had been the voice of kid in the play), she expressed her concern about radiation induced cancer. *"I firmly believe that cancer is a man made disease."*

That alone should be enough to stop uranium mining.

59. MARILYN MANZER of Lower Burlington - BRIEF

She had researched uranium exploration and mining for a year and a half, and concentrated on (1) dangers inherent in uranium exploration, and (2) the strength of existing regulations. Her property had been trespassed on, and her complaint to the Department of Mines and Energy resulted in an apology. Exploration activities such as drilling could release radon gas into the atmosphere, and the Bates Commission of Inquiry in British Columbia had identified several uranium exploration activities as having the potential of releasing radio nuclides - road building, stripping and trenching and test pitting, drilling, adits and shafts where concentrations became much higher, and sample and core storage.

As for the Nova Scotia regulations governing uranium exploration, she thought that the guidelines should become regulations. There should be a requirement of a sump tank in an excavation to contain drilling muds, sludge and unused cuttings. A monitoring program should be instituted for drilling programs more in line with the Bates Commission. Consideration must be given to casing of drill holes where they may penetrate aquifers. The guidelines should deal with exploratory adits and shafts. Core storage facilities should be restricted to authorized personnel. The guidelines should deal with site monitoring of gamma radiation. There should be more public access to information. Public warnings should be displayed where outcrops of rock are specially radioactive. There should be penalties for non-compliance, the posting of bonds by exploration companies to cover damages, monitoring should be done by an independent agency or government at company expense, and the Department of Mines should not be *"in the* *ambiguous position of being both promoter and regulator of uranium exploration and mining."*

[NOTE: The Commission considered this brief to be the major presentation by the opponents of uranium mining as to the regulatory aspect. R.J. Mc.]

She also quarrelled with the idea that uranium exploration should be allowed whether there were ultimate mining because *"it is unethical to allow private industry to spend millions of dollars exploring for uranium if they were never to be allowed to mine it."*

Her other concerns were that nuclear power is a dangerous technology, that disposal of high level radioactive wastes was an unsolved problem, that most uranium mined is used to fuel the arms race, that there were severe environmental effects around mines, and that there was detriment to health of worker and public and to the well being of society in the area.

60. KATHY ALDOUS - SLIDES

Mrs. Aldous, who was the voice of Lamb in the play, made a slide presentation showing farm life in the area, accompanied by a commentary.

61. FRED VELDHUISEN of Riverside - BRIEF

He noted the possibility of error in design, construction, operations and repair of equipment used by the nuclear industry. *"Machinery out of control is always a problem but the nuclear industry out of control would be a catastrophe."* There was no safe disposal of radioactive waste. As a former watchmaker in Europe he recalled factory girls putting brushes to their lips which they used to paint luminous numbers on watch dials. The point contained radioactive material, whose effects were then unknown, and the girls died of cancer. As a member of the Canadian Army at Camp Petawawa, he had been sent to help clean up an accident at the atomic energy plant in Chalk River, Ontario. A year leter lumps appeared all over his body, and scars remained where some had been removed. So far, no lump had been malignant.

62. MATTHEW SIEMERS - PARODY

"To mine or not to mine, that is the question
Whether 'tis nobler in the mind to suffer
The cancer and genetic damage of allowable radiation
or to speak out against a sea of geologists."

A parody of the famous "to be or not to be" soliloquy of Hamlet.

MEETING NUMBER EIGHT - MAY 18, 1982

ACADIA UNIVERSITY, WOLFVILLE

6.3. PATRICK J. SMITH - BRIEF

His presentation concentrated on the process of the Inquiry and on a balancing of costs versus benefits. He made five recommendations and supported his position with 22 references.

Mr. Smith was critical that his initial questions and concerns as to health and environmental effects were unanswered by industry or regulatory agencies. For example, the Serpent River was contaminated for some 30 miles to Lake Erie from tailings from the Elliot Lake uranium mines. Yet Industry said that effects were minimal. *"Any alternative must consider costs/support for interveners, if such a debate as that posed by uranium mining in Nova Scotia is to be resolved on reasoned grounds."* In weighing costs and benefits, he dealt with risk aversion, risk balancing, cost effectiveness to make something safe, and in cost-benefit balancing whether each falls on the same people (minus, shareholders). He argued that *"the burden of proof should be on the man (or industry) who wants a change."* Future generations should not be committed to tackle problems which we do not know how to handle.

His brief had five recommendations.

(1) a 20 year moratorium; (2) the Inquiry to deal with cost-benefit; (3) the Inquiry to report on procedures in consideration of public policy; (4) uranium companies should post a suitable bond; (5) the Inquiry to encourage legislators to visit Elliot Lake and elsewhere.

64. NEIL van NOSTRAND - BRIEF

As an organic gardener and farmer, he spoke against uranium mining on environmental, economic and moral grounds. There would be permanent contamination of the area surrounding a mine site. There is no shortage of uranium in Canada or the world. Eighty percent of uranium is used for bombs.

Mr. van Nostrand quoted the reply of an Indian chief to the President of the United States in 1855 regarding the proposed purchase of the tribe's land. The Indian considered that the white man felt that *"the earth is not his brother, but his enemy, and when he has conquered it, he moves on ... His appetite will devour the earth and leave behind only a desert."*

65. DR. MICHAEL BRYLINSKY - BRIEF, SLIDE

He concentrated on environmental problems associated with the release of radio isotopes from the operation of a uranium mining and milling process. The release would be at a greater rate than would occur under natural conditions. And the uranium would be *"no longer contained in a "relatively protected and inactive natural environment"* The technology does not now exist whereby wastes at a shut-down operation could be contained - he defined such technology as long-term, low-maintenance and preferably walk-away. He dealt at length with the discovery that radio isotopes were being concentrated by factors of 10,000 and even 100,000 times greater than that occuring in the abiotic environment. *"This phenomenon, known as food chain concentration, or more popularly, biological magnification, raises many questions with regard to the environmental consequences associated with the long term release of low-level* *wastes."*

Revegetation, as proposed by local spokesmen for the mining industry to stabilize tailings ponds, might be aesthetically pleasing but tends to increase the rate at which radio isotopes enter living components of the environment. Furthermore, they were non-degradable pollutants, and there are no evolved natural treatment processes that can render these materials harmless.

He made two conclusions at the end of this major presentation:

(1) the Annapolis Valley was highly dependent on an agricultural economy, and was characterized by a relatively low fertility and short food chains. Both conditions accelerated the transfer of radio isotopes to man. Think what would happen if apples became radioactive;

(2) a uranium mining operation based on present technology would essentially constitute an experiment from which *"we could not easily extract ourselves."*

Dr. Brylinsky's brief noted eight references.

66. HEATHER LEIGH - STATEMENT

She spoke as the representative of Mar Nat, a cooperative dealing with natural foods, and of EOS, a natural food storefront in Wolfville. She was concerned with any health threatening contaminants to natural foods *"as human beings are at the top of the food chain, we are subject to a greater risk than other species because of the increased potential of concentration of a contaminant through the food chain."* She also noted that in this small province, no uninhabited buffer zones exist between uranium on sites and towns and farms.

67. GWENYTH PHILLIPS - BRIEF, SLIDES

The nuclear industry suffered from a problem of credibility, in her opinion, because industry and government regulators *"continue to misrepresent fact in the hopes of making radiation risks acceptable."* She objected to being labelled as anti-nuke or anti-technology by those in favour of the uranium industry, and preferred to be called pro-health or pro-environment. Her main concern was the health of worker and of public.

As to the health of the worker, she presented figures to show the incidence of cancer was well above expected among uranium miners in Colorado between 1950 and 1974, and among uranium miners in Ontario between 1955 and 1980. She argued that *"it is quite likely that if a mine were developed at Millett Brook, the gamma radiation exposure would be greater than that allowed under A.E.C.B. regulations."* She based this conclusion on a 0.2% ore grade, the source of that figure being Gordon Dickie, geologist with Shell Resources.

Ms. Phillips attacked the ALARA principle which is to keep exposures as low as reasonably achievable, *"economic and social factors being taken into account."* She thought that this dismissed the safety of the individual. She noted that a number of wells in the New Ross area had levels of uranium above the acceptable limits, but that there was minimal scientific information concerning the health effects of ingested uranium. Many people were asking whether the extensive drilling by uranium exploration companies has had any effects on the uranium concentration in the New Ross wells. Perhaps the Commission could subpoena the information possessed by the companies.

The final part of her brief dealt with the disposal of uranium mine tailings. *"It is very clear that at the present level of technology tailings cannot be maintained over the long term without integrating with the environment."* Her brief contains 21 references.

MEETING NUMBER NINE - MAY 19, 1982

ROOM 132, BEVERIDGE CENTER, ACADIA UNIVERSITY, WOLFVILLE

68. THE VALLEY MEDICAL SOCIETY - BRIEF

DR. W.L. PHILLIPS and J.D.A. HENSHAW presented a review of 62 major studies pertaining to the health effects of uranium exploitation. *"People fear low level radiation in part because our senses (sight, smell, taste) cannot detect its presence. The effects of low level radiation cannot be determined at the time of exposure; it is only after a period of time ... that the effects of low level radiaton become obvious."*

The Valley Medical Society had passed a resolution in November, 1981, in which it endorsed a moratorium *"until the public is assured that the health risk is alleviated."*

Ionizing radiation when absorbed by tissues will knock electrons out of the atoms and molecules, and may alter the integrity of biological material. The degrees of exposure range from death at approximately 500 rads, chromosome aberrations in white blood cells at 5-25 rads, and apparently no clinical signs below 5 rads.

Ionizing radiation is about us at all times. Background radiation comes to us from the environment (cosmic, internal and external gamma) and from man-made sources (x-rays, fallout from nuclear explosions, nuclear power, and VDT's and television) in proportions such as 102 mrem/year environmental and 83 mrem/year man-made.

There can be genetic damage from radiation exposure, and it may take several generations to show up clearly. *"We find ourselves looking at a situation where we know that radiaton causes genetic defects but we* *don't know at what radiaton dose this occurs."*

The brief goes on to look at studies involving nuclear dockyard workers, inhabitants of a Brazilian village located on monazite soil which included thorium and uranium impurities, inhabitants of a similarly situated village in India, whose soil included thorium, and the survivors of the atomic bombs dropped in Japan. It asks *"what effect does continued exposure to low level radiation compared with single dosage have on the rate of mutation?"*

Their study then looked at cancer studies with such findings as:

The range of radon concentration was lowest in wooden houses, and, progressively, higher in brick houses and highest in concrete buildings (Sweden); Radiologists have the highest mortality for all rates of cancer (United States); and Nuclear workers have six times the proportional mortality for their age group (United States).

They referred to the experience of miners, of Pacific Islanders exposed to fallout from an H bomb test, of A bomb survivors, of those radiated for medical reasons, and occupational exposure, and concluded *"low-level radiation causes both genetic damage and cancer induction."*

Their study next turned to uranium mining and its effects upon health, such as lung cancer in miners, in the United States, Canada, Sweden and Czechoslovakia. They questioned the findings by the International Commission on Radiological Protection (ICRP) as to permissible dose standards. Such standards by virtue of Canadian regulations have the force of law. Should this be? Is ICRP making the right decisions?

The authors questioned the mathematical analysis of risk of low level ionizing radiation using experience of high dose levels to extrapolate.

"It has been accepted virtually unanimously by the scientific community that there is no safe dose and that no threshold level exists below which there are no effects."

The ICRP had dispensed with a permissible dose and suggested the ALARA concept. ALARA is defined: "as low as reasonably attainable" social and economic factors being taken into account. Or as the brief said, *"the scientific basis for determining allowable exposure to nuclear workers has been dismissed and replaced with a political-social arbiter."* The brief took issue with the current permissible dose of 5 rem/year for occupationally exposed persons. This limit has been determined by assuming a linear hypothesis where effect is proportional to dose. The linear hypothesis at low levels has been determined by extrapolating results obtained from effects of high level radiation. The linear hypothesis was questioned, at page 47, on four grounds:

1) fractionation may increase carcinogenicity;
2) with exposure to highly energetic radiation such as radon, the risks are still relatively high with decreasing dose;
3) alpha radiation is biologically much more damaging than gamma radiation, *"thus the effects of different types of radiation cannot be compared in determining risk factors;*

4) assumption that radiation repair at low dose levels reduces risks of such doses is in question since it has been shown that radiation repair may actually enhance carcinogenicity.

Pages 49-65 concerned public health safety. The brief noted problems with water supplies at New Ross and Harrietsfield and suggested *"it* *would seem not only reasonable but imperative to determine whether or not exploration for uranium and other minerals has resulted in unusually high levels of uranium in the drinking water."*

They quoted extensively from Ralph Torrie (see Meeting 21) regarding the hazards from tailings. As for radon gas, the increase to the existing natural level at distances away from a tailings pile is small, but tailings continue to release radon for over 100,000 years and *"the sum ... could be large in absolute terms."*

Was there a safe way to manage tailings? Before the tailings became radiologically inert, there would be seepage, and if vegetation were planted on top there would be a radioactive uptake by grazing animals, and there would be groundwater contamination. It would be difficult to delineate the dominant flow paths of groundwater because *"in Nova Scotia, uranium mineralization appears to be confined to intragranitic fractures."* There was always the possibility of accident at an engineered facility, or of design weakness, or of shoddy construction practices or of improper operating procedures.

The brief contains nine recommendations, the first two relating to the ensuring of the health of uranium miners, the third to gamma or wide body radiation, the fourth to an assessment of the operation of the Atomic Energy Control Board, the fifth to proof that *"drilling activities will not disrupt the pattern of groundwater flow and will not increase the uranium content of drinking water"*, the sixth to the need for containment of tailings via the long term, the seventh to dealing with *"the unsolved problem of the radium/barium sludge."* the eighth to controlling the release of radon near a mine/mill complex and, finally, the ninth to solving seepage and groundwater contamination from tailings.

69. PEGGY HOPE-SIMPSON - BRIEF

As co-ordinator in Nova Scotia for "Project Ploughshares" she felt that *"the opponents of current nuclear policies have little confidence in government and industry being able to make the decisions which are in the best public interest."* The main question was a whole range of technologies which are racing ahead of our ability to control them.

She noted exports of nuclear material from Canada to the Soviet Union, West Germany, the United Kingdom and the United States, the common ownership of uranium mines and manufactories of parts for nuclear power and nuclear weapons, and the concern of many people *"which national flag does a nuclear weapon fly?"*

Mrs. Hope-Simpson was not assured by the United Nations Non-Proliferation Treatv nor bv the safeguard role of the International Atomic Energy Agency. Argentina, a customer of Canada for the CANDU reactor (at a loss to this country of $130 millions) has not yet signed the treaty.

Her own preference was that *"we as a nation put our full time and energies into developing sustainable labour intensive systems of living based on conservation and renewable energies."* Among the benefits would be less strain on the environment and saving of money.

She would not argue that non-production of uranium in Nova Scotia would solve non-adherence to the treaty or production of nuclear weapons, but if supplies of fissionable and potentially fissionable material were cut off country by country there would be *"hope of survival of civilization beyond the year 2000."* She concluded that *"when we say: No to nuclear war we are saying: No also to uranium mining in Nova Scotia."*

70. JEAN B. LEUNG - BRIEF

She has tried to become informed about what she called *"a pending development in our province"* and wanted *"to know the predicted effect on the Annapolis Valley if radon gas is carried by the wind to the Valley from a possible mine site on the south mountain."* Mrs. Leung was also concerned about the effect of low level radiation upon animals and poultry, where the reproduction rate is more rapid than among people. Her ethical concerns dealt with the small amount of employment for a short period of time which would be created by a mine, or, as she said, *"to make a short term solution which creates long term problems,"* notably dealing with tailings.

Quoting a federal source, the Department of Energy, Mines and Resources, Canada would use only 18% of uranium produced, the remaining 82% being exported or stored. *"It is possible that we could produce* (in foreign-made nuclear weapons) *what could end our nation and even the human race."* She made four recommendations:

1) cease exploration and put a moratorium on uranium mining;
2) more study and public information on the potential effects of mining exploration and mining;
3) public licensing hearings for applications for uranium mines;
4) mining firms must (a) show a proven waste disposal system, and (b) set aside money as an environmental and health damage deposit and for the monitoring and maintenance of tailings in perpetuity.

[Note: I have broken down number 4 recommendation into (a) and (b) parts - R.J. McC]

71. DONALD and RUTH CONRAD - BRIEF

The Conrads have been farmers since 1958, joined by their son and daughter-in-law two years ago, and Mrs. Conrad (who read the presentation) had worked from July, 1980 to January, 1981 as a part-time secretary for one of the mining companies. The brief concentrated on the effects of uranium mining on agriculture.

Their own farm was primarily dairy, but seven of its 400 acres were for orchard and U-pick. There were 170 acres of woodland on the South Mountain, the ridge running from Vaughans in Hants County to Yarmouth County. This land would be cleared in time to grow feed crops. The Annapolis Valley was the most productive agricultural area in Nova Scotia, and Kings County led the way. This claim was supported by statistics. For 1980, agriculture in Nova Scotia had farm cash receipts of $196 millions and farm expenses of approximately $140 millions. Mrs. Conrad did not believe that the short term (10-15 years) benefit of an increase in demand for farm products created by a uranium operation would justify the capital outlay.

Her work as a part-time secretary for a foreign uranium mining company was briefly described. There was *"reluctance to answer questions and the incorrect information I was given made me quite suspicious that there was something very wrong here."* The company didn't bother to get permission to go on lands to explore *"unless this could be done with very little inconvenience."*

She was concerned about exploration in the Halifax and Kentville watershed lands. She did not feel her concerns were lessened by assurances from the company, as to use of the latest technology.

A uranium mine would produce radioactive dust and *"we are concerned that this dust carried by the wind would cause wide-spread contamination."* Radioactive contamination was not a designated peril covered by the operations of the Nova Scotia Crop and Livestock Insurance Commission, and no insurance company would insure against it.

She was also concerned about the possibility of highway accidents involving trucks taking hydrofluoric and sulphuric acids and anhydrous ammonia to a uranium mill and uranium hexafluoride (or yellowcake) from the mill. And *"lands used for uranium mines, mills and tailing ponds are unreclaimable."*

Farming, practised from time past by Indians and the European settlers in the Valley, was a renewable resource. In contrast uranium mining was of little importance.

The Conrad brief contained four recommendations:

1) A 20-year moratorium on uranium exploitation;
2) The Provincial Government study the level of uranium in wells;
3) The exploring companies make available their test results on well-water samples;
4) Financial help should be available from the Provincial Government for experts at future stages of the Inquiry

72. PAULINE CUDMORE - BRIEF

She was happy to have the opportunity to participate because *"it is through this means that governments respond to the wishes of the people."* Her first concern was the increase in lung cancer among miners from currently recommended radiation exposures. She noted the high content, at 85%, of radioactivity in ores from which uranium had been removed, and *"the solution hasn't been found elsewhere"* as to handling wastes. There were seepage, breaches in dams and breaks in tailings lines. Specific examples at Elliot Lake, Ontario, were given. Operations which were supposed to represent the latest technology proved to be untrustworthy.

Uranium mine-mill sites were generally located in Canada in sparsely populated areas without much agricultural activity. The Annapolis Valley was in use for fruit growing, dairy production, beef, hog, poultry and sheep farming, and forestry. Uranium mining would be a short lived venture; food production had taken place more than 300 years.

At Elliot Lake, Ontario, there were excellent tourist facilities upstream from the uranium mining operation, but on the flowside and, for several miles downstream there are no fish. *"The fact remains there is no known, safe method of permanent disposal of uranium tailings (which) create a hazard for hundreds of thousands of years "*

One must also ask about the use for uranium - a minimal amount for medicine, most for nuclear power and nuclear weaponry. *"In no way do I wish uranium mined from this province to contribute in any way to the threat of nuclear war."*

She suggested that should the Inquiry deem it necessary to go beyond the stage of community hearings that participant funding would be made available and experts representing the views of public concern would be brought forward.

73. KINGS ASSOCIATION TO SAVE THE ENVIRONMENT - BRIEF AND SLIDES

The presenters for K.A.S.E. were GLYNN BISSEX and GWENYTH PHILLIPS. The former dealt with the history and work of the Association, which was formed in 1981, and with what is involved in uranium exploitation. The latter was concerned with the problems associated with uranium mining. Their brief concluded with four suggestions.

Slides showed that approximately half of Kings County had been claimed for uranium exploration. The first site showing promise was in neighboring Hants County, at Millet Brook, not far from farming country and the town of Windsor. Millet Brook flows through agricultural lands and into the Avon River.

If a mine were developed at Millet Brook, there would be approximately 2-4 pounds of uranium oxide per ton, and left over would be almost a ton whose volume would be increased by approximately 60% since it is finely ground.

The waste from the milling operation (acids, chemicals and finely ground ore) is put in a tailing pond. *"It is the management of these waste disposal areas which create the problems for the environment because 85% of the initial radioactivity in the ore goes to the tailings ponds."* The brief dealt with the problems of management at Elliot Lake.

K.A.S.E. thought that *"the dams built with present technology have a 20-30 year life expectancy at best."*

Bissex concluded his part of the presentation with the point that environment problems existing at Elliot Lake were blamed on the presence of pyrite in the rock, which oxidizes to produce acid which, in seepage, would dissolve radionuclides and heavy metals. *"However a study by*

Senes Consultants, Willowdale, Ontario, has shown the presence of pyrite in most samples of Nova Scotian rock sampled" - in other words, similar situations could exist at Elliot Lake and in Nova Scotia.

Gwenyth Phillips said radionuclides cannot be destroyed or biodegraded but were *"a unique pollutant which cannot be removed from the environment. Unlike other pollutants, the damage caused by radionuclides cannot be reversed."* The biological effects of low level radiation are not yet known, and the long half life of most radionuclides (thorium 80,000 years) provided a frightening legacy.

Noted were negative effects on agriculture, tourism and recreation from a short term "adventure", the "crude" technology for building dams, questionable economic benefits (80% of up to 200 jobs would go to skilled labour not available in Nova Scotia, the possibility that no royalties would be paid if the mine did not show a profit, and adverse effects on the health of miners and the public.) Radionuclides from tailings ponds could pass into the environment, and some (e.g. radium) *"are taken up by biological systems as if they were nutrients, like nitrogen or phosphorus. As you go down the food chain you could get what is called biological magnification or concentration."* But to date very few studies had been done.

Each of us is exposed to background radiation, the average being 185 mrem/year natural and man-made. Nuclear workers and uranium miners, allowed to receive 5000 mrem/year of whole body dose had adverse health effects such as much higher incidences of lung cancer - chromosome abnormalities or genetic mutations were caused.

The conclusion was that *"if we begin to mine, we can't turn back, there's no room for mistakes. Industry asks us to give them a chance to prove themselves; however Nova Scotia cannot afford such an experiment."*

K.A.S.E. has conducted many public meetings and the brief set out the six most commonly asked questions - the hazards in all mining, provincial revenue, effect on health around a mining area, control of tailings, stopping exploration on one's land, and whether exploration can cause harm.

There were four recommendations:

1) There should be no mining of uranium in Nova Scotia until there was safety for miners and a solution to the problems of tailing management;
2) Exploration should not be allowed to continue *"until it can be assured that it does not affect water quality, and it does not increase the levels of uranium in deep water wells;"*
3) There should be public funding if the Inquiry goes on to further phases;
4) There should be a recommendation that the Premier of Nova Scotia use his influence to encourage the federal government to appoint a Royal Commission into all aspects of the nuclear industry including government regulation of such.

Among the slides were comparisons of mining locations in remote areas of the large provinces of Saskatchewan and Ontario, and of the small province of Nova Scotia.

MEETING NUMBER TEN - MAY 21, 1982

BURKE EDUCATION CENTRE, ST. MARY'S UNIVERSITY, HALIFAX

74. DR. EMERO S. STIEGMAN - PRESENTATION

Dr. Emero S. Stiegman, who is Professor of Religious Studies at St. Mary's University, thought that no profession should be recognized as *"the experts ... in a question like ours that affects people in so many ways."* Nobody else could assume responsibililty for his political decision about uranium mining in Nova Scotia.

Such mining would be unwise for four reasons:

1) it would not be an effective way of meeting energy needs because of the short term cost benefits and its effect on our quality of life;
2) it would not promote the economy because of losses that would result in agriculture and tourism;
3) it would present serious hazards of radio-active exposure to our health;
4) *"it is only wishful thinking and massive deception which allows peaceful uses of nuclear energy to be separated, in the popular mind, from the nuclear chain that ends in the stockpiling of atomic weapons."*

He said proponents of uranium mining offered the criterion of acceptable risks against these arguments, but these were *"arbitrarily determined without scientific proof ... by hirelings for the industry"* who should be ignored on the basis of conflict of interest.

75. HALIFAX WEST HIGH SCHOOL - BRIEF

This presentation was compiled from research by some 75 students, followed up by a core group of 15 who conducted additional research. The presentation was made by ANN MARIE WOLICKY of the editing team, which also included Michelle Veinot and Natasha Sodlie. Supervisor was Bob LeBlanc. Illustrations were by David Hebb and Stephanie Ash and the typing team was Aurelio Sablone, Miss Ash and Deric Noble.

The students first dealt with the social and political aspects of nuclear technology. Would there be progress or burial? Nuclear medicine saved lives. But there was the danger posed by *"the use of power politics backed by nuclear weapons"* or of accidental nuclear war. Canadian sales led to weapon strength in India - what about South Korea and Argentina? Lastly, there was the possibility of accident at a nuclear power plant.

Their second part dealt with the control and disposal of waste and the present day lack of a long-term disposal system. There would be leaching into the environment from cracks in a tailings pond, from evaporation and subsequent precipitation being contaminated, and, from overflowing. The brief dealt with the break down of radioactive materials, and paid special attention to radon and its daughter products.

Radon is heavier than air, is blown by the wind along the ground, and gets deposited on plants which are eaten. Or it is transmitted by water and ends up in the water supply. Tests at 13 buildings in the Halifax area which operated with wells showed an increase of radon in the air after showers were run.

Their third area of concern was the hazard of radiation to man and his environment. They were concerned, that possible mining sites were close to agricultural areas, unlike Saskatchewan. *"How would you sell* *products from an agricultural area so contaminated"* by radium 226? There was also the increased incidence of skin cancer among those subject to greater exposure by alpha radiation. Humans could receive radiation indirectly through the food chain. *"Of all the people affected by radiation, children will be the most harmed because they are still growing and are not fully developed."*

The students concluded that *"uranium mining is unsafe for Nova Scotia"* and made a three-part recommendation:

1) a moratorium on exploration, mining and milling in Nova Scotia;
2) research during those seven years;
3) an inquiry at the end of the seven years *"to evaluate whether all of these problems have been corrected;"* and if not, to extend the moratorium.

The report contains 22 footnotes.

76. DONALD WEERAN - PRESENTATION

Four ethical considerations should be taken into account by parties concerned with uranium mining in Nova Scotia:

1) *"Physical life is a value which should not be risked for a value equally high or higher"* - practical examples of such a choice being to rush into a burning building to save a child vs. to crowd into a night club assuming there are adequate exits;
2) Good conduct cannot be secured by regulations alone;
3) Fair compensation should be furnished to parties disproportionately penalized by a change in a moral contract;

4) Ethical principles warrant sacrifice if sacrifice is needed to implement them.

He looked at such developments in Nova Scotia as the Sydney steel mill as examples of non-residents who have made the people of the province "pay and pay hard when they have to pick up the pieces of these industrial disasters." Uranium development would leave people waiting *"for the ticking time-bombs of cancer and genetic mutation to go off."*

77. MICHAEL MARSHALL - PRESENTATION

Nova Scotia had a different geography than the Canadian shield in the North. Canada had progressed through several images - in 1870 the Dominion from Sea to Sea (significantly the work of Nova Scotian George Munro Grant), and in the 1890's the Tomorrow Country. Not much heed was paid to problems of pollution created by mining companies and it could not be said that the Canadian shield was cottage country.

Nova Scotia was also small - 1/200th of Canada, half the size of Iceland or Cuba, Ireland was half as big again and New Zealand four times. Three European countries - Denmark, Belgium and Holland - were about its size. We have known a large population per square mile compared with other parts of Canada. The interior is not barren of roads and villages unlike New Brunswick and Newfoundland.

In Nova Scotia the way *"to happiness is to do a little farming, a little fishing, a little wood cutting."*

78. JANET BAKER - READING

This teacher read a paper prepared by one of her students who feared that the development of uranium in Nova Scotia would be a Faustian bargain.

She promised to turn the paper in later to the Inquiry.

79. VINCENT CALDERHEAD - BRIEF

A cost benefit analysis will ultimately take place in deciding whether uranium mining should take place, and questions of priorities, personal values and ethics will serve as fundamental starting points. Mr. Calderhead began by looking at the sources of radiation danger: at and near mines - radon; from mines - dust particles with absorbed radiation; water at or near mines - freshly exposed uranium ore; and tailings ponds - containing 85% of the radioactivity brought to the surface.

"What is surely at the root of all misgivings about uranium mining (is) that people are petrified by the fear of cancer." He considered that there was no safe level of exposure to radiation. Canada did not need mine uranium and he objected to its use in thermonuclear weapons. If uranium were to be mined in Nova Scotia long term cancer rates would rise, a few score jobs would have been created, and there would be fuel added to the nuclear arms race. He hoped Nova Scotians would not be like the fish who pursues *"the lure of sustenance being offered him without realizing the tragic consequences."*

80. ALAN RUFFMAN - BRIEF and SKETCH

A contrast was made between the half lives of civilization and of uranium tailings piles. *"Countries really have no reason to talk in time periods longer than civilizations"* whose half life of 1,000 years was two full orders of magnitude less than that of a tailings pile. Mr. Ruffman argued that research and conclusions as to genetic and mutation time scales would be much longer than several generations, indeed *"long past the life of all of us."* We would not know the answers and there were no conclusions, and the Inquiry was in effect conducting a risk analysis that could not be based on data. *"One must make an emotional decision - in fact a gut decision."*

He presented a sketch of the Halifax watershed at Pockwock, and made two recommendations:

1) No staking or exploration in the watersheds;
2) Public money for protagonists at subsequent stages of the Inquiry.

81. DR. C.J. BYRNE - BRIEF

A professor of English literature, he read the poem *"Halibut Cove Harvest"* by the Nova Scotian writer Kenneth Leslie which he thought contained the pattern of the way the Nova Scotian economy had always gone. The poem told of the displacement of the handline fisherman in his dory by the trawler. Coal had given way to oil after the last war and *"whole communities in the province were decimated."*

Mining uranium would not bring benefits to Nova Scotia but *"only the detriments and we will be left to repair the damage"* - dead fish, dead forests, dead people.

[Kenneth Leslie's poem, as Dr. Byrne mentioned, is contained in "Introduction to Literature" published by Holt Rinehart and Winston. Its editors included colleagues of Byrne, among them the following speaker. R.J. McC]

82. DR. KENNETH MACKINNON - BRIEF

The depression and the Scandinavian attitude towards the environment were touched upon by Dr. MacKinnon, and he reasoned that Canadians too should be more conscious of regulation and of planning. *"We are beginning to learn that many industries left unregulated are not good deals."* There was *"Canada's futile nuclear industry."*

Worthwhile regulations would set safe standards of protecting the public health and the public use by regulations. He questioned the effectiveness of enforcement by the Atomic Energy Control Board.

In Nova Scotia, *"the Bluenose has always felt pretty comfortable within his 18th century American belief in preventing the politicians from having control."* He was concerned that *"local and provincial government in Nova Scotia has not had the tradition of making serious demands on outside firms locating in the province."*

Dr. MacKinnon considered that the advantages of uranium mining and milling (employment and royalties) could not outweigh the disadvantages (overstimulation or distortion of the local economy, and environmental hazards and damages). In the long run there would be medical costs for former miners and residents of the former mining area, which would be borne by the province.

In the development of energy sources he favored alternatives, to the nuclear route. *"We should learn to develop our own appropriate technology for our resources and our culture."*

The brief draws upon the experience of the Scots in setting up trust funds to deal with disruption of occupations and of the social environment from the North Sea oil industry.

MEETING NUMBER ELEVEN - MAY 25, 1982

BURKE EDUCATION CENTRE, ST. MARY'S - HALIFAX

83. THE NEW BRUNSWICK ELECTRIC POWER COMMISSION - BRIEF

The presentation was made by Dr. T.S. THOMPSON, manager of public affairs, who welcomed the opportunity *"to discuss the importance of nuclear development to the Maritime region."* That province is the site of the region's first nuclear generating station at Point Lepreau, where construction had begun in 1975 and where start-up occurred after this presentation in 1982. Nuclear energy does not yet enjoy as strong public support as it does in Ontario.

"It is a high technology born in war time, shrouded in secrecy for years, held up to false promises, and come of age when technology itself is suspect" People were generally unaware of the extent of nuclear development in research, agriculture, medicine and industry. Over half the world total of cancer treatment units, about 1400 Canadian built, have extended the useful lives of people by 11,000,000 years. Canada also supplied 60% of the world's medical diagnostic radioisotopes. Canada was the world's second largest producer of uranium, of which 80% was exported. This country was sixth in the world in lifetime nuclear electricity generation, all of it in Ontario where in 1981 uranium was the largest single fuel source of electrical generation. Seen in Maritime terms, the 1981 production from Ontario's nuclear plants was nearly six times the total electrical generation in Nova Scotia. Nor was nuclear development in the Maritimes confined to Point Lepreau. The heavy water industry in Cape Breton was important. It consumed process steam and electricity for the plants at Glace Bay and

Port Hawkesbury, representing almost 20% of the total revenue of the Nova Scotia Power Corporation. They employed 800 and put $100,000,000 into the provincial economy. There had been a considerable technology transfer to Nova Scotia. Heavy water-related work accounted for 10% of the contract work of the Nova Scotia Research Foundation.

Medically, hundreds of Maritimers underwent diagnostic procedures using radioisotopes, and the region has five Canadian-built cancer therapy machines using gamma emitting cobalt sources, and would soon have three linear accelerator therapy machines. In research, Dalhousie University in Halifax had one of the six Slowpoke (Safe Low Power Critical Experiment) reactors in Canada. *"None of this would exist or be possible without the use of uranium as a fuel in nuclear reactors."*

Pages six through thirteen of the NBEPC brief concerned the Point Lepreau project (in 1983 a second plant there was announced by the New Brunswick government) as *"one of a successful family of CANDU plants."* Its output would be cost competitive, and would become increasingly so, *"as world oil prices continue to rise."* High technology had provided new job opportunities for many New Brunswickers, in the engineering group at the Research and Productivity Council in Fredericton and Combustion Engineering at Moncton. The Canadian Nuclear industry was unique in that it *"was launched and nurtured through the vehicle of state enterprise"* Atomic Energy of Canada Limited, Eldorado Nuclear, Ontario Hydro, Quebec and N.B. Power.

Dr. Thompson noted that nuclear policies such as the ones being considered by this Inquiry are complex. Processes have had to change to satisfy concerns. The Atomic Energy Control Board had moved from a "professionally closed" to a "democratically open" regulatory process. *"The mutual professional trust between the regulator and the licensee staff is being replaced by a more democratically open, adversarial-type process."*

Inquiries elsewhere were noted in Ontario, Saskatchewan, British Columbia, and New Brunswick and, abroad, the United Kingdom, Australia and New Zealand, in which both sides of the debate were well represented and "in all cases, given certain conditions, continued nuclear development, be it uranium mining, nuclear electricity production, or fuel reprocessing has been endorsed or supported." But the inquiries had *"not resolved the divide between the technical, social and political aspects of the nuclear question. We have not yet achieved effective communication. This appears to be a real challenge to our democratic system."*

Pages 17 through 23 dealt with the need for future nuclear development for the future well being of the region, the principal point being the over dependence on oil. The solution was *"conservation and substitution or reduce and replace."* There should be a *"greater use of electricity manufactured from domestic resources."* The sales of coal - and nuclear-generated electricity by N.B. Power to Prince Edward Island and New England were reported on.

He concluded that *"further nuclear developments involving uranium and CANDU power plants require the public to recognize the need and benefits of using this domestic resource and technology to substitute for scarce and costly oil at home and abroad."* It was his purpose to relate N.B. Power's perspective on that need and benefits to the Inquiry.

(After his presentation, Dr. Thompson was asked by me about the final disposition of the Lepreau plant when its life was over, and the materials would have to be disposed of, and he replied that he expected such technology would be in place in, say, 2015).

84. THE MINING SOCIETY OF NOVA SCOTIA - BRIEF

The presentation of the oldest mining fraternity in Canada, which traced its roots to the Gold Miners Club of Nova Scotia founded in 1887, was made by PETER A. HACQUEBARD, its President. Supporting material came from DON W. POLLOCK and ALADAR B. DORY.

The main presentation said that the government imposition of a moratorium upon uranium exploration had badly affected exploration activities in Nova Scotia. There was a decline of *"some 75% as compared to previous years. Of this decline 20% can be related directly to the moratorium."*

Dr. Hacquebard said this decline was most serious because of its direct effect on the mining industry per se, and its indirect effect on related industries and on employment. The Society was a voluntary organization whose purposes were to provide technical and managerial information, to press for just laws and unite against unfair practices against the mining industry. To deal with the uranium issue it had prepared technical matter for the public and held a panel discussion at Sydney during its 1983 annual meeting.

The principal points were:

1) Uranium exploration could be carried out with acceptable safeguards to miners, public and the environment. *"This critical conclusion was reached by several independent inquiries held in Canada and*

elsewhere."

2) Uranium exploration is not carried out indiscriminately in Nova Scotia but is regulated by special licenses which enforce strict health and environmental controls.

3) Mining and exploration was of critical importance in Nova Scotia; in 1981, $261,000,000 in production, $1,600,000 in royalties, some 12,000 employed. Uranium exploration had added $30,000,000 to the local economy in six years.

4) The geological conditions in Southern Nova Scotia *"resemble those in Europe, where in granitoid rocks uranium is found in association with other ones, such as tin, tungsten and molybdenum."* Abandonment of the search for uranium would affect the exploration of these other metals.

As for the safety aspects, there had been monitoring of radiation at Millet Brook by Aquitaine Company of Canada Ltd. (predecessor of Kidd Creek) and no deleterious effects had been reported on environment and the workers. There was no techncial justification for the ban on the issuance of licenses. The brief noted that the public is generally willing to accept considerable risks associated with everyday life *"but is not willing to accept radiation risks associated with nuclear industry, even though they are by one or two orders of magnitude lower."* The lack of credibility towards the mining industry was the result of past mistakes that have or can be rectified. The mining industry must speak more openly.

The degree of hazard from groundwater contamination depended on the chemical composition of the tailings and the nature of local soil conditions. The Department of the Environment has promised special guidelines and regulations.

The Society had dealt with environmental concerns at the Sydney meeting, and one point was made that nuclear generation of electricity was not necessary because there could be adequate production from conventional fuels. Questions from the floor *"felt that this nuclear-free conception of society was not realistic."* Other questions were critical of the support given by the Nova Scotia Medical Society to the moratorium, as being "a somewhat hasty and arbitrary decision not based on fact." The Society had not consulted with the Nova Scotia Departments of Mines and Energy and Environment.

(The views being challenged, of Susan Holtz of Ecology Action Centre, are condensed in reports of Meetings 40 and 26).

The Society concluded that adequate safeguards could be put into place at mining sites, and that mining exploration including uranium prospecting should be encouraged or mining companies would go elsewhere. It recommended *"that the uranium moratorium be lifted, and that each uranium project be judged on a site-specific basis."* Millet Brook was merely an interesting possibility and needed considerably more testing. Regulations regarding the safe mining of uranium should be introduced now rather than when actual mining is about to commence - this had already been done for the prospecting phase. Federal regulations already exist.

The Society concluded that uranium mining was necessary because it would contribute to the general economic welfare, and because uranium is needed as a source for the generation of electricity in many parts of the world. Conventional fuels were not sufficient to meet the demand.

"It would be a default on our part if Nova Scotia would not take advantage of such a rich endowment as uranium deposits."

Safety aspects of uranium exploration were dealt with in a paper of Don Pollock presented to the Inquiry but not read. There was the preliminary stage, by airborne spectrometric survey, followed up by ground crews using hand-held spectrometers. Then came the intermediate stage, using some or all of: detailed spectrometric prospecting, geological mapping, geophysics, line cutting, geochemistry, trenching and diamond drilling. At the detailed stage there would be closely spaced diamond drilling and bulk sampling of ore, the latter usually from underground access.

As the steps progressed so did the need for control of safety and environmental hazards. The principal concerns were the health of explorers and possible contamination of ground and surface water and of air. Aquitaine had used all the activities except bulk sampling.

The following practices were used with certain results:

1) Gamma dosimeters for the trenching and handling of diamond drillcore maximum values recorded were normal background;
2) Radon daughter products monitored in the well ventilated enclosed areas - reading less than .01WL;
3) Systematic chemical analysis of surface waters in areas of diamond drilling - results reviewed with the Department of the Environment *"and in all cases, the waters are typical of those in Nova Scotia;"*
4) Radon daughter products are measured in free air close to and away from trenches in mineralization - results are just (Nov. 21, 1981) being received;

5) Diamond drill holes cemented from bottom to top except for those which contain piezometers as requested by the Department of Environment;

6) Trenches backfilled except for a few left open for inspection by visitors.

Dr. Pollock's conclusion was that *"all results to date clearly indicate that Aquitaine's exploration activities have had no deleterious effects on the environment and on the workers. Since the Millet Brook project is at an advanced stage it can be reasonably stated that exploration for uranium can be carried out safely and that there is no technical justification for the government's present ban on the issuance of uranium licenses."*

The Inquiry also received the paper on "Uranium Mining in the Canadian Social Environment in the Eighties" by Aladar B. Dory of Atomic Energy Control Board of Canada, which was presented to the Uranium Panel discussion at the Sydney meeting. His views were given the Inquiry at Meeting 17.

MEETING NUMBER TWELVE - MAY 26, 1982

O'BRIEN BUILDING - WINDSOR

85. RALPH LOOMER - BRIEF

This well-known humanist of the Annapolis Valley felt that the Inquiry had assumed a heavy responsibility in the democratic process, and commended the provincial government for setting it up. He was very anxious that Nova Scotians become familiar with *"life perils of nuclear developments and what uranium mining will take from our province."*

Mr. Loomer was confident that if enough information is provided, nearly everyone would oppose the creation of very temporary uranium communities, and of extensive areas of waste disposal with cesspool ponds containing radioactive sludge.

The uranium market would collapse without nuclear power and weaponry. As for the former, there were sufficient sources of energy. Conservation and the use of renewable and available sources - sun, wind, vegetation and water power - would meet most areas of energy deficiency. All were based on energy income, not on depletive capital, and were low in technology, that is, easy to understand and use.

As Mr. Loomer saw it, *"major developments of such 'soft energy' techniques would create employment of people with more ordinary trade and work skills; at the same time, the extortions of the centralized energy consortiums and cartels could be moderated."*

He pointed to the alcohol and methane fuel potential in stock feed, the possible production of fuel from hay and grain, and of methane from corn, beets and livestock manure. Another source was steam generated by many industries; yet another was the development of many small hydro-power sites.

As for the nuclear threat, he thought that scientists and people in the public (nuclear) regulating authorities were in the trap that their personal future would suffer if they *"make too much of the unsolved and unknown hazards of the nuclear cycle."* A policy of secrecy had begun with the development of the atomic bomb, and permeated the industry and regulatory bodies.

He philosophized that *"as the entire nuclear history illustrates ... we have never been able to devise human institutions dedicated to minimizing their own activities. This is particularly true of nuclear technocrats."* The nuclear technological revolution was a stunning achievement which called into question wisdom, not cleverness.

The yellowcake extracted from Nova Scotia would not be used only for nuclear power, because the major market for uranium is the arms race. Canada, more than any other nation, has the potential for peace keeping and peace making.

He mentioned the Nuclear Liability Act, passed in 1970 and proclaimed in 1976, which limited the liability of the nuclear installation operators to $75,000,000 (to be covered by insurance) and placed the balance on taxpayers. He thought that the Act was designed to encourage development of the nuclear industry.

Tailings from the yellowcake production presented the greatest overall threat to public health in the whole nuclear fuel cycle. Uranium mining in Nova Scotia would worsen the human predicament and mortgage the future for generations. *"Let us leave it in the ground."*

86. **JANE BISHOP - BRIEF**

As a teacher of Grade 12 chemistry, her involvement was over a period of time, and nuclear chemistry was a part of what she taught. She considered that she had entered the uranium mining question with a fairly open mind but now had only one point of view - *"We do not need a uranium mine in Nova Scotia."*

She and her husband lived on a very productive farm, with an orchard, dairy herd, and fresh fruit and vegetable outlet. Established industries - agriculture, forestry, fishery and tourism - would be jeopardized if a uranium mine were opened.

Farm statistics in Nova Scotia disclosed that cash receipts from sale of farm products totalled $203,481,000 in 1980, and produced wages of $21,627,000. She quoted Roy John, (then) environmental affairs officer for Kidd Creek Mines, that Millet Brook would create 80 new jobs with an average yearly salary of $17,000, or in total (in her calculation) about $20,000,000 less than agricultural wages. Peripheral operations were not included in these figures.

As for waste disposal of tailings, *"there is no safe way of dealing with the wastes as of now."* Radionuclides travelled in the environment. *"If the radionuclides are present in soil, air or water and we as farmers grow crops with this water then our crops will contain radionuclides as well,"* which could be passed on in the food chain to humans and other animals.

She thought that these statements were directly contradictory: (1) there would be eventual integration of wastes with the environment (AECB) and (2) a uranium mine operated by Kidd Creek would have no hazards whatsoever to the environment, to the water or to the worker.

Mrs. Bishop concluded that the generation of electricity by nuclear reactions was fascinating, and a tremendous scientific discovery, but produced *"great problems that we do not as yet have solutions for. Perhaps we have gone too far too fast."* She asked that agriculture be chosen over uranium.

87. CITIZEN ACTION TO PROTECT THE ENVIRONMENT (C.A.P.E.) - BRIEF

C.A.P.E. thought the O'Brien Building a suitable site for the meeting, since the public debate in Nova Scotia began here when the West Hants Council passed a resolution against uranium development more than after a year before. Other major meetings had followed. C.A.P.E. itself was formed in late April of 1981, and *"while none of us make any claim to be experts we feel that some of us now have an extremely good lay knowledge."* C.A.P.E. had been formed to oppose uranium development, and among the goals identified when it registered under the Societies Act was to work for a moratorium. It received no government funds, and its funds were raised from used book sales, yard sales and the like.

The brief examined the development of the industry in Canada, uranium export practices in relation to uses, and whether there was a need as an energy source. The history began when the United States required uranium for its first atomic bomb and there was no uranium mine anywhere in the world. A defunct radium mine at Port Radium in the Northwest Territories was re-opened to mine uranium. Another source was the Belgian Congo. Later the United States developed its own sources and the Canadian industry slumped.

Then came the 60's and a second boom, with the huge international expansion of the civilian nuclear industry. A secret uranium cartel kept prices high. *"It is still illegal in this country for those with an inside knowledge of the operations of the uranium cartel to make public statements on the subject."* At this stage, mines were being closed down in Saskatchewan, and Ontario, because of low grade ores, but an aggresive push to open mines in British Columbia and Nova Scotia was on.

The brief referred to other public inquiries in Canada and applauded the Nova Scotian government for initiating this Inquiry. C.A.P.E. wanted public funding to help its work. Otherwise as citizens its members would support the Canada Development Corporation (owners of Kidd Creek Mines), the Nova Scotia Department of Mines and the Atomic Energy Control Board. *"We do not object to taking part in a David and Goliath combat, but at least David never had to pay for Goliath's armour."*

As for uranium exports, it was impossible to make a distinction between civil and military nuclear trade. The brief dealt at length with the enrichment process. Very little of the uranium mined in Canada ends up in CANDU reactors. About half goes to countries with a nuclear weapons commitment - Great Britain, France and the United States.

"Where uranium is mined, many miners and company officials sleep soundly enough at night in the confidence that ***their*** *pound of uranium is used only for peaceful purposes."* But much was used to manufacture nuclear weapons, and it was impossible to identify the source.

The Non-proliferation Treaty contained no restrictions on the rate at which the Soviet Union, Great Britain or the United States could add to their nuclear arsenals, and in any event it was toothless because a signatory could withdraw without penalty upon 90 days notice. The International Atomic Energy Agency had a conflicting role to promote and police nuclear commerce, and was *"unlikely to be able to perform both functions adequately."* In any event, it only has the power to report violations and not to prevent them.

C.A.P.E. took issue with the amount of protection coming from the use of cameras in fuel bays to ensure that plutonium would not be taken from CANDU reactors. What about cameras used in department stores to deter shoplifters?

The brief turned to the nuclear generation of electricity. Other energy sources were used so that a nuclear reactor could provide such electricity, by *"the basic nuts and bolts of steam power. No wonder the plumbing is a problem."*

An amusing development was noted in France when two different schools of thought were considering energy options. The conservationists thought that electric heating of buildings was the most expensive and inefficient use of energy, so a program was started by government-phasing out electric heat. Another crowd thought there was too much dependence on foreign oil, developed the use of nuclear reactors, and then had to meet expenses by more sales - phasing in electric heat.

"In the Maritimes, because most of our energy needs are for space heating and transportation, only about 10-12% of our energy use is in the form of electricity." Dependence on the fragile delivery system made a region vulnerable because of storms. Conservation was the largest untapped energy source, and more research was needed on conservation measures and alternative energy technologies.

Other sources were: use of waste heat (an example, that from cooling milk on a farm), hydro-electric power through a device rather like an airplane propeller, power through methane production from biological or vegetable wastes (Acadian Distillers at Bridgetown), and power from the low pressure steam generated by many industries.

The brief concluded that for political, economic and ethical reasons there should be no uranium exploitation in Nova Scotia. On the other hand, C.A.P.E. considered that *"the industry would prefer the decision to be made in a moral vacumn."* There were 22 references and several sketches. The principal presenter was Peter Siemers. (The balance of the C.A.P.E. presentation occurred at Meeting 27).

MEETING NUMBER THIRTEEN - JUNE 4, 1982

HANTS COUNTY WAR MEMORIAL COMMUNITY CENTRE - WINDSOR

88. KIDD CREEK MINES LTD. - TOUR, BRIEF, SLIDES

The Commission visited the Millet Brook area before the public presentation which was well-attended both afternoon and evening. Presentations were made by Dr. GEORGE MANNARD, President of Kidd Creek, Dr. DON POLLOCK, regional manager of exploraton, DENNIS MILLER, superintendent of special projects in Timmons, Ontario, and ROY D. JOHN, manager of environmental affairs, at the afternoon meeting. In the evening two outside specialists were presented, Dr. DOUGLAS CHAMBERS, the executive vice president of Senes Consultants of Toronto, on worker protection and environmental concerns and ROBERT TURTON, principal of Golden Associates of Halifax on tailings management.

For the company, Dr. Mannard welcomed the Inquiry and promised cooperation. *"Mineral exploraton is a complicated proposition and the 3 million dollars spent at Millet Brook until the moratorium has only yielded very preliminary information."* Looking ahead to the submissions on safety, environmental concerns and tailings management, *"you will hear ... that, for all stages of the mining cycle there are in use procedures and technology that reduce potential hazards to levels that are within the most stringent standards."* Kidd Creek Mines Ltd. was incorporated as Texasgulf Canada Ltd. on March 15, 1965, under the laws of Delaware, U.S.A. Its present company and 100% owner, Texasgulf Inc., became owned in 1981 by Canada Development Corporation and Societe National Elf Aquitaine of France, and in the division of assets by these two Texasgulf Canada Ltd. changed its name to Kidd Creek Mines Ltd. and became wholly owned by the Canada Development

Corporation. The company has its own advisory board, drawn from leading independent corporation executives, the academic world, the Corporation and Kidd Creek management. The total assets at the end of 1981 aggregated $1,650,000,000, and it had $388,000,000 in sales in that year. Its main asset was the Kidd Creek Mine in Timmins, Ontario.

Insofar as Millet Brook in Nova Scotia was concerned, Aquitaine had a 2/3rds interest in the uranium exploration project prospect at Millett Brook which now belonged to Kidd Creek; the remaining 1/3rd was held by Dome Petroleum.

The brief went into the Timmins operation, to stress the concern for pollution control (such as the turning of sulphur dioxide fumes into soluble sulphuric acid) and management of tailings, and its pride in the prestigious National Ryan Award for safety. The company had a well-developed policy of providing information to the public. In Nova Scotia, presentations had been made to schools, community groups and media.

In Canada, seven companies now produced uranium, 7,152 tonnes in 1980 at a roughly estimated value of $750,000,000. Their output put this country second in the non-Communist world to the United States; the Communist bloc does not release production and reserve data. In this country, 87% of the 68,750 megawatts of energy produced in 1980 came from nuclear power, and in 1981 Ontario Hydro purchased 1,050 tonnes, Hydro Quebec and New Brunswick Electric Power Commission 90 tonnes each. The major international customers for Canadian uranium were Japan, West Germany, Great Britian, and Spain; smaller amounts for Italy, Finland

Sweden and Switzerland; very little for the United States. *"Before a company can make sales to an offshore customer the proposal must be approved by the Government of Canada."* Dr. Mannard considered that Canada has the most stringent regulations in the world. The Federal government required a 30 year uranium reserve for domestic use before allowing international sales.

Dr. Mannard's presentation covered pages one through sixteen. He was followed by Don Pollock on uranium exploration in Nova Scotia (pages 17 through 25). He noted the presence of uranium *"to some degree throughout most of the world"* and in some places sufficiently abundant so as to form an ore body.

The geological concept which gave rise to exploration in Nova Scotia was *"the similarity of* (Nova Scotia's) *geology to that of parts of France, Portugal, Spain and England. These areas contain numerous economic deposits of uranium, tin and tungsten."* Nova Scotia had once been part of a large continent including parts of Europe, but had drifted away. *"Nova Scotia should therefore contain ore deposits similar to those now being mined in Europe."*

In Nova Scotia exploration started with a reconnaissance radioactive survey, using a detector mounted on a helicopter. This measures the amount of gamma rays constantly given off from the ground. Higher amounts detected would be anomalies which would be followed up by prospecting using hand-held equipment. Exploration would become more detailed and expensive, using geophysical equipment for which lines of sight must be cleared through the bush. Trenching by back-hoe and diamond drilling are used. The company stresses that laws relating to trespass and the property rights of others be complied with.' Kidd Creek had found claims with a potential for tin and tungsten, but not uranium, and prepared to continue exploration for these. At Millet Brook, airborne detection had discovered the anomaly in 1976, and over one dozen occurrences of uranium mineralization have been located by ground exploration. *"Diamond drilling has shown that three of these contain enough material to be considered potentially mineable."*

About 1,500,000 pounds of uranium at an average grade of about 0.2% have been indicated at Millet Brook. *"The grade is not higher but is comparable to that of similar deposits being mined profitably in France."* However, additional reserves would be required *"to consider a mining operation"* and this could only be determined by more exploratory drilling.

The company had more than complied with the guidelines adopted by the provincial Department of Mines and Energy and of Environment. Water quality studies have been carried out since 1980 and air quality monitoring was begun in 1981. About $3,000,000 had been spent of which 90% went to Nova Scotian residents mainly in Windsor/Wolfville area. In 1981 Aquitaine had 40 people on its provincial payroll, and proposed spending about $2,100,000 for Millet Brook in 1982. When the moratorium was imposed most of this went to other provinces. In 1982, 15 people would be employed and $700,000 probably spent in the search for other commodities.

"One of the problems that Kidd Creek and others face is that much of the land in Nova Scotia that has uranium potential, and as a consequence

cannot be explored, also has tin-tungsten potential. A ban on exploration for uranium has the unfortunate side effect of eliminating exploration in some areas and hampering exploration for other types of deposits."

The development of a mine and mines were covered by Dennis Miller (Pages 26-34). Many studies would be carried out to determine the viability, culminating in a feasibility study which may take a number of years to prepare. The studies would include:

(a) general - topography, climate, population, access, services and sites;

(b) geological studies of structure and mineralization;

(c) mining method, plans and layouts, labour and equipment needs;

(d) metallurgical testing including pilot plant testing;

(e) ancillary sciences such as power, water, fuel and transport and workshops, offices, laboratories, etc. *"(At Millet Brook, due to the proximity of major centres, a townsite would not be required");*

(f) capital and operating costs estimates to include costs of environmental protection and tailings management;

(g) marketing analysis;

(h) rights and ownership;

(i) environmental studies. An example would be an Environmental Impact Statement which would be presented to the regulatory agencies involved;

(j) economic analysis including calculation of cash-flow schedules.

A method of mining would have to be chosen from three - open, underground or in-situ leaching. *"In-situ leaching can only be used when the ore has a very porous nature that allows liquids to permeate through it. As this is not likely to be the case with Nova Scotia deposits, this method will probably not be applicable."* He described open pit mining, whose ultimate depth would be determined by the stripping ratio *("the amount of waste rock which must be removed to maintain the pit slope compared to the amount of ore removed for each unit of pit depth")*, as the most desirable where possible from a cost viewpoint.

The alternative, underground mining, would involve the sinking of a shaft to provide access to underground workings from which ore would be removed and waste material placed in the void created *"to maintain ground stability and prevent future subsidence of the surface."*

It may be possible to use both methods at Millet Brook, open pit at the top portion and underground beneath. *"Should adequate reserves be proven, these deposits could support a small scale mining operation with a production rate of approximately 400 metric tons per day,"* which would feed one central milling facility employing about 200 people over 10-30 years. The French mine at LeBernardan, occupying 74.87 hectares or 185 acres was comparable.

The afternoon session concluded (pages 35-40) with the presentation of Roy John. As manager of environmental affairs for Kidd Creek, he dealt with processing or milling, the last step in the extraction cycle. The steps in the process were:

Crushing - using heavy crushing equipment, usually within a building, possibly underground, to reduce the ore to a size suitable for grinding. Negative air pressures are used to prevent the escape of dust. A ventilation system would maintain low radon levels. The crushed ore is ground, in a process using iron balls, rods or large rocks, to a sand-like material.

Leaching - mixing of this ground ore with chemical reagents and oxidizing agents, to bring uranium into solution. Reagents such as sulphuric acid must be handled carefully. The systems must be chosen carefully, built well, include dykes, ventilators or by pass lines, have automatic safety systems, and have inspection/awareness/training of safety.

Liquid/solid separation - separating the uranium in solution, assisted by settling agents or flocculants. The "pregnant liquor" or uranium bearing solution goes to the next process and the barren rock to tailings neutralization.

Solution upgrading - concentrating of the pregnant liquor is done by ion exchange (that is, run through a column of beads which absorbs the uranium) or by solvent extraction (that is, mixed with a kerosene chemical mixture which absorbs the uranium. It is washed from the kerosene.)

Uranium precipitation - treating the solution with an alkali such as ammonia. The uranium drops out of solution in the form of yellow particles.

Uranium thickening and filtration - settling or thickening takes place and the clear water drawn off, then filtered.

Drying and packaging - drying takes place in a special oven, producing "yellowcake". A dust collector is used to return any material picked up to the mill. The powder is loaded into a standard 45 gallon drum, fitted with a rubber gasket, and the lid locked with a ring closure. The drums are placed in a standard ventilated warehouse.

Transportation - taking to its market by standard commercial truck. Yellowcake is weakly radioactive and an appropriate label is attached to the side of the truck.

Security - being of standard industrial plant style.

As he concluded the afternoon presentation, Dr. Mannard said *"we hope that we have conveyed an impression of the magnitude of our operations and our awareness of our responsibilities as a corporate citizen."*

The evening presentation concerned three areas of concern - worker protection, the environment and tailings management - with the purpose, as stated by Dr. Mannard, *"informed judgments may then be made about the nature and extent of restrictions to be placed."*

Dr. Chambers (pages 44-63) first considered protection of workers. There were no unique industrial safety hazards because the mining of uranium was similar to the mining of other types of ore so that conventional safety issues would not be discussed. Most industrial health concerns-exposure to dust, maxims and toxic gases and fumes, hazardous chemicals, noise and vibration - were common to uranium and other mining projects, and to many other heavy industries.

At uranium mine developments there was the additional need to monitor and control radiation levels. Uranium was different from other common metals because of radioactive decay, so that it constantly was changing into a series of other elements. Such elements, or radionuclides, underwent decay by emitting ionizing radiation, in uranium, the three types of ionizing radiation were alpha, beta and gamma radiation.

Alpha radiation will just penetrate the surface of the skin and can be stopped by a sheet of paper, and so was only hazardous when inhaled or ingested in food or water. Beta radiation can pass through one or two centimetres (less than one inch) of water or flesh. Gamma radiation can pass through the body, but one can be shielded by dense materials, such as concrete, lead or steel.

Bodies will absorb some of the energy of ionizing radiation, but *"it is important to understand that alpha, beta or gamma radiation does not cause the body to become radioactive."* The absorption is commonly referred to as a radiation dose and is quantified using the unit, the rad. When the different biological effects of different types of radiation are taken into effect, the dose equivalent or dose which results is described by the unit, the rem. *"One rem of radiation produces a constant biological effect regardless of the type of radiation."* Dose rate expressed in terms of time (rem per year or mrem - one thousandth or milli-rem per year.)

The brief also pointed out that the unit of measurement of radioactivity (as opposed to radiation dose) was the curie, abbreviated as Ci. One such is approximately equal to the number of disintegrations per second occurring in one gram of radium - 226, a uranium daughter. Small quantities of radium are found in nature; and are usually expressed in pico curies (pCi) or one one-trillionth or one million-millionth of a curie.

He mentioned other frequently used units - the roentgen (R) to measure gamma and/or X-ray intensity most commonly reported in microroentgen terms or one-millionth R; - working levels (WL) to measure the concentration of short-lived radon daughters in air. Exposure to such was commonly measured in units called Working Level Months (WLM).

These historical units were being replaced by new international units (S.I.) but most data were still reported in historical units. We live in constant exposure to ionizing radiation. As cosmic radiation, it comes from sun and outer space. It comes from virtually all rocks, soils and water; it comes from the air we breathe; our bodies are radioactive. We produce radiation exposure by medical x-rays, nuclear medicine, industrial isotopes and chemical fertilizers, nuclear explosives testing and the operation of nuclear power generation facilities.

In recent years there was considerable public debate, partly touched off by uranium exploration and mining, and *"disagreement among scientists has resulted in public confusion and concern. Various models have been used to predict the effects of low level radiation exposure. The effects at these low exposures, however, are so small that it is difficult to verify any one theory conclusively."* In Canada for the purpose of protection, *"it is commonly assumed that the likelihood of potential health effects varies directly with the dose received right down to zero dose."* Standards were based on the recommendations of the International Commission of Radiological Protection (ICRP), an independent non-governmental body made up of recognized scientists including Canadians which came into being in 1928.

Current regulations limit the whole-body doses to atomic energy workers in Canada to 5 rems per year. Radon daughter exposures are limited to 4 WLM per year. For the public, radiation exposure standards are one tenth those of atomic energy workers (0.5 rem/yr.)

EXPLORATON - Exploration workers would be exposed from radon daughters in the air, or from handling radioactive materials brought to the surface. Radon gas measurements in six provinces and states, including Nova Scotia, *"indicate that the radon released during drilling and from drillholes does not measurably alter outdoor radon levels beyond the immediate vicinity of a drill."* But concentrations can increase in buildings or poorly ventilated areas, but in properly ventilated buildings this is not a problem.

As for radiation from rock cores, exposure was low and, as measured by dosimeters worn by the exploration crews, less than the public limit (0.5 rem/yr.). Hazards at the exploration stage would be kept low by personal hygiene, proper handling of radioactive materials, putting distance between storage and normal working areas, spending as little time near radioactive materials and ventilation prior to and during storage.

MINING AND MILLING - Worker exposure to radon daughters, airborne dust and external gamma radiation were concerns. Ventilation in underground mines was the most important to control the first two. *"Modern uranium mines use single pass ventilating systems, which take fresh air to a single work place before being exhausted."*

Other work practices included: watering down broken ore piles, sealing off worked-out areas, using respiratory protection, shielding, distancing from source and using time limits, and using water spray and chemical fixants on haul roads.

In open pit mines radon and dust were removed by wind currents and atmospheric dilution, and experience in Canada demonstrated that *"radon daughter levels and dust concentration are normally well below regulatory limits."*

In the mill, local air collection systems gathered the radon daughters and dust and there was additional reduction by general ventilation air. Beta radiation exposure was controlled by safe work practices, good personal hygiene, gloves and safety glasses.

There was close monitoring of working areas, the provision of personal radiation and air monitors to the workers, and keeping personal exposure records which were available to that individual. On-the-job safety training was provided.

This part of the presentation was illustrated by slides which dealt with such matters as annual radon daughter exposures of Canadian uranium miners *("fewer than 50% ... were estimated to have received exposures greater than 1 WLM")*, the distribution of annual external gamma doses among workers (from less than 0.4 rem per year to about 0.8, averaging 0.42), and analysis of uranium in urine to monitor the effects of uranium dust inhalation or ingestion *("average values are below the level of 50 micrograms of uranium per litre commonly used as an investigation level.")*

The typical Canadian would be exposed to 285 mrem annually. The principal sources where double figures were concerned were:

Man made radiation from medicine and dentistry	73
Cosmic radiation	44
Terrestrial radiation	40
Radionuclides in body	18

(Extracted from the longer table presented - R.J. McC)

Dr. Chambers then dealt with environmental considerations, again concentrating on the special problems relevant to uranium. Radon gas as an example would be released by drilling.

AIR IN EXPLORATION - Measurements in Canada and the United States *"indicate that exploration drilling does not have an observable effect on ambient radon levels beyond the immediate drill site area."* Nor did trenching operations. In Nova Scotia boreholes in which there was uranium mineralization are filled with cement to eliminate this concern. Diamond drilling, often used to collect cores, was a "wet" drilling technique that generates little or no dust.

SURFACE WATER IN EXPLORATION - The water, or slurries of water and mud, used in diamond drilling is circulated to a reservoir or tank to allow settling. Radionuclides were removed and sometimes burial was used to dispose of the mud. Tests in British Columbia showed that drill muds contained uranium concentrations little different from background levels.

GROUNDWATER IN EXPLORATION - Contamination from drilling was a theoretical possibility in Nova Scotia, but drill holes encountering mineralization were *"cemented thus eliminating this concern."*

WATER QUALITY IN MINING MILLING - Contaminated waste waters were treated before being discharged. In the mill waste waters would become a slurry, being mixed with rock particles, would be neutralized and sent to the tailings management area. *"All water discharged from the tailings area is treated to reduce contaminants to acceptable levels."*

Where the acidic type of milling process is used, the slurry is treated with lime before discharge to the tailings area. Nitrogen compounds and radium were usually the two major environmental considerations associated with the effluents from a tailings area. Nitrogen compounds were reduced by natural biological deterioration or by rainfall.

During milling some of the radium in the ore was dissolved, which raised the level of radium above local pollution control objectives in the tailings area. Barium chloride was added to form an insoluble precipitate which could be removed.

AIR UNDERGROUND - Water sprays limited dust levels. They are not 100% efficient so that some radioactive dust, aerosols and radon gas are exhausted outside. (In open pit operations the dust levels can be controlled by water sprays and chemical fixants.)

AIR IN MILLING - Atmospheric emissions occur at each stage and are subject to these measures:

Crushing and grinding - dust collectors;

Leaching - air cleaning devices;

Remaining steps - dust collectors for yellowcake dust

AIR AT TAILINGS AREA - This is the largest source of dust and radon. Levels of dust nearby have been found to be small relative to background levels. *"In the past, dusting problems have occurred at non-operating* *tailings areas in Canada which had dried and not been surface treated."* Surfaces have been stabilized with use of vegetation. Dust monitoring had demonstrated that major sources were construction activities and unpaved roads, and the effect was limited to the immediate vicinity of the tailings area. The typical dust concentrations were below one microgram per cubic metre within one kilometre compared to 20-40 microgram per cubic metre in rural areas.

Some radon would migrate through tailings into the atmosphere, but were slowed down in wetter climates such as Canada. *"Studies at Elliot Lake and other locations have shown that radon emissions decrease rapidly with distance from the source. Average radon concentrations are indistinguishable from background levels ... within 1 to 2 kilometres."*

Possible effects on the public were assessed by a pathways analysis, which would *"estimate the exposures to those persons most likely to receive the highest doses."* At Elliot Lake for example people with the largest exposure were calculated to have received less than 0.01 rem per year or about 2% of the public exposure limit. *"For comparison this difference is about equivalent to the radiation dose received during two flights from Halifax to Vancouver and is less than the radiation dose one would receive in one year as a result of moving from a wooden to a brick house."*

MANAGEMENT AFTER CLOSE-OUT - This would include measures to minimize surface drainage into the area, containing and vegetating the tailings, maximizing runoff from the tailings area, and minimizing the use of mechanical devices and other features that require regular maintenance. Once the flow of slurry had stopped, water was treated and released. The solids were contoured, fertilized and seeded. Rain and snow or leftover water in the tailings would pick up contaminants before seeping out, so it was important to minimize the amount of water that entered. Surface flows were diverted around a tailings area, and runoff was helped by proper contouring and vegetating. Radium gave the most concern, but its release would be slower than during operations. Iron sulphide could have a negative effect but is present in only small concentrations in Nova Scotia ores.

Pathways analysis would be used to assess long-term radiation activity and exposure for members of the exposed populations. A properly closed out operation would release lower levels of radionuclides than is allowed during operation. *"The only restrictions necessary would be to prohibit the use of the area as a building site or a source of construction materials."*

Dr. Chambers concluded that technology and methodology were available and had been used successfully for many years, during mining, but were less developed for the long term. Efforts were being made in Canada *"to improve existing techniques and develop the optimum long-term approaches to tailings management."*

The final portion of the Kidd Creek presentation was used (pages 77 through 87) by Robert Turton to deal with tailings. Mr. Turton is an engineer who received his Master of Science degree specializing in soil mechanics, and (at presentation) had spent over 10 years dealing with compaction control and tailings management.

Solid particles would be placed in a containment which would function during the operation of the mine and afterwards. The objective in such containment was *"that the quantities of contaminants which enter the environment from the tailings area are reduced to the point that the contaminants have no acceptable impact on the environment."*

The type of containment depended on the countryside - perimeter dykes in flat acid areas of the southwestern United States, use of depressions with permanent dykes at their outlets in the rolling topography of Canada. Water would become clean as solids settled from the slurry in impoundments, allowing the water to be decanted on its way to a settling treatment pond. Enroute it received barium chloride which took up the radium so that the water could be released. The site must be selected for the short and long term.

The factors to consider in selecting the site included the length of pipelines, avoidance of excessive pumping, maximum natural containment and minimum dam construction, minimum seepage, availability of materials to build the dam, isolation from major water causes and aquifers, and remoteness from habitation.

As for dams, the design used the principles developed to retain water. Dam building was an ancient occupation and *"today there are hundreds of engineered earth dams in existence, many reaching heights of several hundred feet."*

Because process water was eliminated upon close outs, dams to contain tailings are inherently safer in the longer term than these retaining water.

The engineering design would be tailored to the geology of the site, and the materials (nearby soils) available for construction, and their ability to shed rainwater. *"The dam is designed to withstand the most severe flood."* Embankment dams were common to contain uranium tailings in eastern North America, and there were *"small or negligible seepage losses which can be controlled."* The control of water was important during the operation of the mine (it *"is collected and treated prior to release into the environment"*) and during close-out (it *"is intercepted and channelled away from the tailings"*). Intercepter channels and spillways are designed to deal with the maximum probable flood.

The first engineering rule of close-out was to choose a stable geological setting during mill operation. Natural containment was found in low-lying depressions (which were relatively untouched by geological weathering as compared to high ground and slopes) and major water courses were avoided. Durable natural sands, and clays were used which have been around for thousands of years.

At close-out, there should be protection against erosion by a permanent cover of vegetation, durable cobbles or boulders, and by drainage channels and spillways. The site should have an impervious bottom and deposits of clay soil nearby. Infiltration of water and melting snow can be reduced by placing a permanent layer of clayey soil between tailings and protection cover. The surface could be contoured to prevent ponding.

"Our preliminary investigation indicates that the Millet Brook site has the geomorphological characteristics which are required to effectively contain uranium tailings." The area contained small depressions, and clayey and free draining soils.

Dr. Mannard again spoke to the Inquiry. He said his company was a sound corporate citizen with an excellent track record in mining, safety, health and environmental concerns. *"The very fact that we are here today, notwithstanding that we do not yet know whether we have an economic orebody in Nova Scotia, bears witness towards our conscientious attitude towards public issues."*

If the moratorium were lifted an operating mine would be perhaps five years away. Issues had now been discussed, techniques and safeguards existed and *"we think the moratorium should be lifted."* The company would continue its commitment to provide public information. Five pages of bibliography and illustratons for every stage are included.

MEETING NUMBER FOURTEEN - JUNE 8, 1982

BARRINGTON ADMINISTRATION BUILDING

89. ALBERT W. PERRY - BRIEF

Concern about the effects that uranium mining would have upon the water supply of Nova Scotians was the theme of this presenter.

He opened with verses 26-28 of the first chapter of Genesis, which dealt with the creation of man, quoted Section 33 (2) of the federal Fisheries Act which made it an offence to deposit deleterious substance in water frequented by fish, and then set out tables in the federal Metal Mining Liquid Effluent regulations.

The Schedule for authorized levels of substances set out the maximum monthly amounts for radium 226 - being 10 pCi/l as the arithmetic mean, 20 in a composite sample and 30 in a grab sample. Another schedule set out the frequency of sampling and analysis for radium 226 - being at least weekly if the concentration is equal to or greater than 10 pCi/l, every two weeks at 5 and at least monthly if at 2.5. (The readings for radium 226 in all instances represented dissolved values after filtration through a 3 micron filter).

Mr. Perry thought that the mill should be shut down immediately when substance levels are exceeded but *"all that is required of the operator is for samples to be taken at weekly intervals."* God had made man to be stewards of the Earth, but *"after examining these two tables we have now decided that Canadians ... are in reality very poor stewards."* Specific reference was made to the Serpent River at Elliot Lake, where the fishing and tourists had gone, and to the spill of 100,000,000 gallons of radioactive waste liquid from a tailings pond, when an earthen dam at Church Rock, New Mexico gave way, so that Navaho Indians lost their water supply and the use of their livestock.

He considered that these results *"will be imposed on us"* if uranium mining is allowed in Nova Scotia. The watershed downhill from a mine all the way to the ocean would be affected, as would the tourist industry.

Air is more than 50% water by weight, as was our food, our body was mostly water, and *"there are no enforceable Canadian or Nova Scotian laws to protect our water from uranium mining."* He prayed that the Inquiry would decide that there is no safe way to mine uranium and that the Legislative Assembly would place a ban on exploration and mining.

90. BETTY JUNE SMITH - ESSAY BRIEF

"To Walk in Beauty" was the right of every Nova Scotian and *"the uranium industry has a history of massive environmental degradation."* Her title came from the Navaho prayer.

Fishing, forestry, agriculture and tourism must be protected from *"the mechanics, so to speak, of uranium development and from the deadly, radiation it would release."* There were six references to the book, "Ruins of the North" by the naturalist Sigurd Olson (publisher Alfred A. Knopf, 1963).

She was concerned that one major radioactive accident *"could instantly ruin for all time the ecology of so small a province"* and even without accidents mining would erase beauty.

91. HATTIE PERRY - BRIEF

As a retired teacher, a native Nova Scotian and an environmentalist, she probably was best known for her strong opposition to nuclear power. In 1978 she had been recognized by the provincial government for her *"outstanding contribution to the enhancement and preservation of Nova Scotia's environment"*

When she was a young woman, *"there were not any massive environmental risks. and I've come to realize that all the risks we face today are as a result of business and industry."* Nova Scotian's did not need uranium, for all of it would be exported, and its only use would be for mining companies to make money and for nuclear arms. It would take about 20,000 pounds of uranium ore to produce a 16 pound bomb. Uranium mining would cost tax dollars for the proper management of radioactive tailings *"that will remain radioactive for thousands of years, during which time they will have to be continuously monitored and guarded."* Atomic Energy Control Board of Canada has had to spend millions on cleaning activities.

The environment was being polluted at a terrifying rate, and *"Mother Nature is giving us advance warning of the devastation which may well come in the increasing incidence of cancers, genetic and somatic effects, and the earlier onslaught of aging diseases."*

She presented figures showing the pathways for radiation which *"cannot be smelled, felt, seen or tasted."* The illustrations showed exposure to man and to organisms.

Radiation would affect future generations. She quoted Dr. Rosalie Bertell that such damage could be as severe as blindness, mental retardation, spontaneous abortions or childhood cancers.

She was critical of AECB because the radioactivity of the public beach at Port Hope, Ontario, was not reported for 24 years, and some homes and schools in that community had above normal radiation levels because uranium mining residue was mixed with landfill. No warning signs existed at the Eldorado Nuclear plant yet she saw fishermen within its sight operating in *"greenish-saffron ... water* (which) *made me shudder."* Blueberries were being picked from a uranium mine's tailing site in Saskatchewan. She thought that these showed lack of concern for the public by government and nuclear regulatory agencies.

She mentioned the condition of the Serpent River and of 10 lakes in Ontario. If we saturate ground, water and air with radioactivity, the end of life is not far off.

She examined existing legislation and thought it did not protect for certain reasons:

Clean Air Act - not legally enforceable because no substances, including radon gas, have been specified as pollutants;

Canada Water Act - does not specify which substances are wastes;

Fisheries Act - does not define "deleterious" or the quantities making it up.

Applause usually took place at the end of each presentation, but there was a considerable amount from the audience when she mentioned dumping of neodymium radioactive isotopes in water at Economy Point in 1977, an area frequented by clam larvae and other marine life.

Metal Mining Liquid Effluent Regulations - they permitted arsenic, radium, etc. to be put into waterways.

Ecological Reserve Act - seems to her to be unenforceable because a mining company was permitted to put a road within the Tobeatic Resource Management area after a joint study by the Departments of Lands and Forests, and Environment.

She thought that the Department of Transportation does not have stringent measures to protect us from accidental spills of radioactive material on our highways, and that the Atmospheric Environment Service should record *"the percentage frequency of direction and speed of the wind"* for Vaughans and other locations where *"viable deposits of uranium"* were found.

She also noted that under the Atomic Energy Control Act of 1946, the AECB would regulate all uranium mining and milling operations, and the Provincial legislation would have no control over those operations or over the management of mine tailings. She quoted from a letter from W.D. Smyth of AECB of October 19, 1978, that a person receiving a Mine Facility Operating Licence had the "responsibility to propose how he will comply with the regulations and licence conditions and for the AECB to approve or disapprove of these proposals." In her opinion this meant that *"the AECB does have regulations, BUT the regulations can be circumvented by the mining companies."*

The AECB also has said, in 1981, that "a maximum of ten years will probably be needed to address the true long term aspects of uranium tailings management", in other words a hope that technology will be available by 1991.

Her conclusion was that *"in view of the proven uncertainties, the known hazards, and the unsolved problems, we conclude that we cannot afford to risk our health, our environment, the health and welfare of future generations, and the ultimate threat of world annihilation. Neither can we allow our government to gamble with these vital things. We must NOT permit uranium mining in Nova Scotia."* Three pages of bibliography, sketches and curriculum vitae of Dr. the Reverend Sister Rosalie Bertell are appended.

92. RACHEL PERRY - STATEMENT

(Read by Ann Smith in her illness)

The beauty of the Annapolis Valley would be gone forever, as would productive crops and birds, if uranium mining took place. Instead of creating jobs it would cause the loss of existing ones.

Scenes at Hiroshima and Nagasaki just after the dropping of nuclear bombs had made her *"angry that Canada supplied the uranium for those bombs."* Uranium should be left in the ground *"where God put it"* and not brought out to explode people to bits, disfigure the landscape, harm wildlife, and cause increases in cases of cancer.

"Nova Scotia is small and beautiful" and *"I hope our government will do its best to keep it that way for me, and for those who will want to live here."*

93. SOUTH SHORE ENVIRONMENTAL PROTECTION ASSOCIATION - BRIEF

The Inquiry's policy of informality paid off with one of its finest moments during the presentation of this 65 page brief. There was a wonderful description of encounters at sea between huge Russian fishing factory vessels and small Nova Scotian inshore boats, the Russians triumphantly talking about the poverty of capitalism and the Nova Scotian talking about free choice. Relative to the Inquiry one might draw the conclusion that surface appearances can be deceiving.

The brief was compiled by ANNE G. WICKENS, the corresponding secretary, and portions were also read and/or written by ETHEREN GOREHAM, president, LAURIE HITCHENS, and BETTY JUNE SMITH.

The area served by the Association was described as having little or no interior settlement in the Southwestern end of the province, mostly with no roads or even trails, and with communities strung along the shore. The Ice Age had left a legacy of granitic debris, and much of the area was swamp, and scrub forest. The remnant of the South Mountain lay along the Bay of Fundy and surface water ran from it to the Atlantic.

Southwesterly winds prevailed and the hackmatack crowns invariably pointed northeast. Many hunters whose compasses had failed found their way to camp by searching out a stand of hackmatack.

The Association contended that *"we have become the people poisoned first and worst by the radioactivity produced by the removal of soil and forest cover for the purpose of exploration for uranium which has already taken place in the Bear River-Digby area".*

The botanical growth in the area was reported. Radioactive poisons could work their way through plants into deer and moose and into people. Experiences in 1966 in Alaska and the North of Europe and Asia among caribou and reindeer eaters were mentioned.

The entire economy was based on the fisheries. Most fishing captains owned their own boats. The coastal area from Lockeport to Digby *"provided the greatest amount of foreign capital per capita in Nova Scotia, not excluding the metropolitan area of Halifax-Dartmouth"* - most of it Yankee dollars. The fishery was demanding, of uncertain financial return and dangerous.

Pages 6-11 make up one of the finest accounts of the iron make-up of these fishermen that one could find anywhere and would be a haven for parents who want real life hero figures for their children to admire. The point was made that any radioactive contamination of fresh water supplies or of ocean water would probably put the fish plants out of business since it now cost $1 per gallon to buy fresh water at New Ross.

Pages 12 to 24 dealt with the Association's concern over changes to the marine habitat, and included 21 references. The habitat would suffer from radioactive contamination coming from uranium tailing run-off. The run-off from any streams in Nova Scotia *"has only 50 or so miles to travel before reaching the Atlantic Ocean."* Nova Scotians had always treated oceans, rivers and lakes with little regard where pollutants are concerned. But uranium tailings are not biodegradable, and were a greater hazard.

Uranium ore was in a natural vault when untouched, with low amounts of radioactive particles escaping. Released by mining and milling, the tailings would pollute the air *"with its dangerous cancer-causing gases radium and radon"* within hundreds of square miles.

South-west of Kejimkujik National Park, where Digby, Yarmouth, Shelburne and Queens County lines apex, was an area of uranium hot spots; it was also an area draining through all counties through fishing villages into the Bay of Fundy and Atlantic Oceans. *"An 800,000 year sentence to the usability of our habitats ... is too much to pay for the benefits of perhaps only a few and more than likely they abide in an environment some thousands of miles from this province and will be free from the immediate contamination we would be bearing."*

The dam break in New Mexico which contaminated a river 75 miles downstream would, the Association thought, in Nova Scotia terms mean contamination of some 20-25 miles into the ocean.

Radioactive materials would absorb strongly to aquatic sediments, and the Fundy tides would *"actively release the radioactive particles ... outward in the ocean."* The coastal fishery would be affected.

Plant life such as Irish Moss would absorb radionuclides and enter man's food chain. There was a need for more research into such absorption.

Studies were referred to to support the idea that planktons were significant in the transport of radioactive materials to deep water. But more research was needed on the effects of radionuclides upon the metabolism of fish, and those done in a laboratory were considered *"to have little if any real validity."* Herring was believed to be a particularly radiosensitive species.

This part of the presentation concluded with the *"fear that any substantial increase in exposure of our aquatic and marine habitats to* *radionuclides from uranium mining tailings would lead to the following results: -*

1) *reduced species diversity;*
2) *reduced numbers of various species;*
3) *increased levels and of radionuclides in our seafood products thus in our human food chain."*

Pages 25 to 39 was entitled "Negative Aspects of the Uranium Cycle." It opened with a consideration of the situation that exists because of the fall of acid rain for many years, so that *"all waters in Southwestern Nova Scotia are below the pH5 range"* and that range was falling. These acid emissions were beyond the control of Nova Scotia. There would be an increase in the mobility of uranium in Nova Scotian waters, *"even without the added disturbance of uranium caused by exploration and mining."*

The point was made that technology does not exist to isolate radioactive wastes from the environment for hundreds of thousands of years. *"There is no means of isolating wastes stored below ground from the water table."* Liners could rip when installed and would deteriorate. If a workable solution were suggested it *"should be subjected to independent review by scientists of similar stature."*

Radionuclides could be released into the environment by spillage, erosion, overflow, failure of embankment, seepage, action of snow and the wind. (Later in the brief freezing and cracking were mentioned.) Seismic design was also a factor because of the Cabot fault through the Bay of Fundy and part of Nova Scotia.

Waste management in other parts of Canada was considered to be unsatisfactory, and in British Columbia the question of jurisdiction was unclear and fragmented between AECB and the provincial Department of Mines. The disposition of wastes should have to be specified and approved in order to obtain a license. AECB guidelines for permeability were based on "bulk average" which were not in accordance with hydrological geochemical concepts.

The role of government to protect the public was dealt with in pages 39-43. The brief thought that misleading information had been given to governments by the nuclear industry, and reference was made to Three Mile Island and events at Port Hope, Point Lepreau, New Brunswick, and uranium exploration in Nova Scotia. Governments were unable or unwilling *"to act with any degree of efficiency,"* to protect their citizens.

Dealing with need, the Association noted that there were sources of uranium in Russia, Australia, Africa and Canada, but in this country we also have energy sources in oil, tar sands, natural gas, coal, wood, hydro and tidal power, and wind and the sun. Furthermore nuclear power plants had a life of 30 years but the expense of decommissioning would go *"on and on and on."*

The health aspects from radioactivity were considered at pages 47 to 59. Its effect was to disrupt the atomic structure of cells so as to transform the atoms into ions (hence the expression "ionizing radiation.") Damage to body cells was somatic, that to future generations was genetic. It took billions of years and 14 different stages for uranium to lose all its radioactivity by becoming lead 206. Ionizing radiation would both initiate cancer and promote cancer initiated by other carcinogens, according to Sister Rosalie Bertell.

Workers would be exposed to higher levels than the public, which would increase the probability of leukemia, and of respiratory cancer.

Turning to the area, uranium exploration and testing in the headwaters near Barrington could put an end to fishing, canoeing, camping, hunting-and-eating deer in and by the Clyde, Barrington and Roseway systems. The problem of uranium content in wells at Harrietsfield, New Ross and Vaughan was mentioned.

From an ethical aspect (pages 60 6o 61), the brief considered uranium to be poisonous and destructive, which should not be used to disturb, contaminate or *"destroy the last wilderness area in Nova Scotia for commercial gain"*, or *"poison the water supply of any Nova Scotian"* or *"run the risk of destroying the present fisheries based economy of Southwestern Nova Scotia for the questionable purpose of producing uranium"* or *"to destroy others"* beyond our borders.

The recommendations were:

Ban exploraton and mining until studies are carried out

1) to show a completely safe method of extraction;
2) to determine the effects of radionuclides now present *"upon the chemical, physical and biological metabolism of aquatic and marine inhabitants"* and
3) to determine the tolerance level of all aquatic and marine life, so that an allowable amount would be determined before exploration and mining is allowed.

Place responsibility for the costs to *"decontaminate the tailings"* upon the operators (if the state did the mining, upon the Provincial-Federal Departments of Mining and Environment).

The presentation concluded on a note of extreme pessimism. Given that the nuclear industry was allowed to exist, was there *"a belief that all of us are already doomed as a result of their nefarious activities? ... May God have mercy on us all."*

MEETING NUMBER FIFTEEN - JUNE 11, 1982

BURKE EDUCATION CENTRE, ST. MARY'S UNIVERSITY, HALIFAX

94. BRUCE ARMSTRONG - STATEMENT

As a writer and author of the book "Sable Island" he felt that Nova Scotia like Sable Island *"needs all the environmental protection it can get."* The enemy, as Pogo once said, *"is us"* because many remain ignorant of the long-range ramification of uranium mining. He wished he had said in "Sable Island" that "one should never, ever accept as final the word of an expert" (quoting John K. Gabraith) because *"that expert can be wrong, often careless and sometimes politically motivated."*

There were no natural or scientific checks against the poisons of uranium tailings and mining. The world must be kept green. *"No matter who we are - experts, writers, businessmen, fishermen, in moments of sanity we must seek refuse in our green world."*

95. VIRGINIA POINT - BRIEF

She was very much opposed to uranium mining and welcomed the Inquiry as a legitimate vehicle for public input into any final decision about it.

Mrs. Point understood that the Inquiry *"heard from a little baby piglet in Centre Burlington"* and started her brief *"with a poem written by a member of the group which has not come forward yet"* - Archy, the cockroach. It was an insect questioning the claim of man, to superiority in "quote and only man is vile quote" by Don Marquis. It was her opinion that *"uranium mining is the epitome of inefficient* *and inappropriate behaviour."* One word summed up the cycle from mining to atomic warfare and that was WASTE. One ton of ore yielded 1,997 pounds of radioactive waste tailings, which would have to be stored safely for 80,000 years, and if the tailings escaped the surrounding environment would become a wasteland. Furthermore, 600 megawatt CANDU reactor produced each day wastes equivalent to the fallout from the explosion of about 1000 Hiroshima bombs. The ten nuclear power reactors in Canada had a cumulative capacity factor in 1981 of 67.8%. Up to 70% of electricity used by appliances is wasted. Electric space heating was about 35% efficient *"due to energy lost in the conversion from steam to electricity and back to heat."* Conservation, insulation and solar use would help eliminate waste.

There were, she concluded, two non-wasteful outcomes from the uranium mining issue. One was that we in Nova Scotia could learn from past mistakes. The other was the Inquiry itself, which *"is enabling people to publicly voice their thoughts through a legitimate process."* There are eight references.

96. CANADIAN INSTITUTE FOR THE ADVANCEMENT OF WOMEN - NOVA SCOTIA - BRIEF

The role of scientific evidence and the burden of proof were the gist of this presentation. The Institute encourages, co-ordinates and disseminates research on women and experiences of women and has about 100 members. Among these are scholars, and two Ph.D's, LINDA CHRISTIANSEN-RUFFMAN and KARIN FLIKEID, who prepared and divided the presentation.

Because many views had already been presented which dealt with environmental, health, community and peace issues as being of special concern to women, the brief would concentrate on the role of scientific evidence in decision-making which concerned uranium. *"As a research institute, CRIAW is especially interested in the way in which research is used in policy making."*

Scientific knowledge rests on assumptions, rational logic and empirical studies which build upon each other, and which becomes modified as new empirical evidence is gathered and taken-for-granted assumptions are questioned.

Often scientific claims and counter-claims are based on different assumptions or models, and *"it is important to recognize the unstated assumptions of scientific arguments."* An example was that the *"common practice in the nuclear industry is to dilute figures on the amount of radiation and its risk by averaging point source radiation over the whole population, the large proportion of which has not been exposed."*

Who has to prove what? How and by whom is the conclusiveness of scientific evidence to be judged? Dr. Flikeid picked up from her colleague to answer these questions. Her answer to the first was that it should *"be up to the promoters of radiation technologies to demonstrate the safety of the procedures involved."* As for the second, industry was better armed with money and the resources of sophisticated public relations experts than its opponents when it came to the rise of a common scientific tool - discredit and pull apart the findings of others. *"As the sociology of science indicates, the allocation of resources has an effect on scientific knowledge at any one time."* The nuclear industry was able to pay and impose terms of secrecy on its own researchers, contrary to the basic openness of science. Government regulatory agencies had a stake in development of the nuclear industry which had an effect that they did not protect against abuses.

The specific area mentioned in several occasions was the study of risks in relation to exposure. The brief suggested that such judgment could be made by those outside the regulatory authority. The final question was the risk involved in making the wrong decision. Assume that the Inquiry made the wrong decision in finding that uranium mining were safe, *"then the cost of being wrong is to expose workers and the public to what in reality constitutes a danger to their health and to that of future generations and civilizations."* Assume that the Inquiry made the wrong decision in finding that uranium mining were unsafe,*"then the cost of being wrong is loss of monetary profit to the industry."*

97. CHAMBER OF MINERAL RESOURCES OF NOVA SCOTIA - BRIEF

A small volume of 50 pages was given to the Inquiry by the Chamber, and its contents were summarized in a presentation by G.B. DICKIE, chairman of the exploration committee. The book was entitled "Uranium Exploration,Mining and the Nuclear Fuel Cycle," and it was prepared by ROBERT TURTON, ROY JOHN, (see Meeting Thirteen), DAN BROWN, vice-president of planning of the Nova Scotia Power Corporation, DAVID MORLEY, public relations with Atomic Energy of Canada Ltd. Chemical Company in Glace Bay, and Mr. Dickie, professional geologist with four years of work in uranium exploration and now an independent consultant.

Their work was conceived some eight months before, and designed to be a layman's guide to the nuclear industry with a Nova Scotian flavour.

It accordingly began with the ABC's of radiation, detailed the activities in exploration, *("It is the Chamber's belief that uranium exploration carried out under the existing Mines Department terms and conditions causes no adverse effects on either workers or the general public")* and reported on the operations of mines in Ontario and Saskatchewan, *("there is no reason why these safe mining practices could not be applied if a uranium mine is ever found in Nova Scotia.")*

Their book dealt with short and long term schemes for tailings management - short term measures were effective in limiting the amount of radionuclides entering the environment, and *"it is quite possible to isolate and manage these areas over the long term with little or no maintenance required."*

The CANDU system was recognized the world over for its efficiency and safety. In some places it provided the lowest cost energy supply and that option should not be lost.

Radiation protection standards were under continuous study by many international commissions and committees, and were considered to be adequate.

The brief noted that at least five Federal agencies and seven Provincial government departments were involved in several years of environmental studies, and public hearings before any mine were allowed to produce.

As for Nova Scotia, exploration for minerals in Nova Scotia had reached a peak in 1981 just before the uranium moratorium. About $14,000,000 was spent (75% staying in Nova Scotia), and 150-200 university students hired.

The moratorium had placed severe limitations on exploration in Nova Scotia, and the opportunity had been lost to develop new mines - uranium and others, because uranium occurs with other metals like tin, silver and copper.

The Chamber asked: *"If a tin or silver deposit is found which contains only a small amount of uranium, can it be mined? How much uranium would be allowed?"* Could Nova Scotia afford to discourage the mineral industry which contributes 4.3% of the gross provincial product.

The tin mine at East Kemptville would have an operating life of 20-25 years, employ 200, cost $100,000,000 to construct, contribute $250,000 to the municipality and at least the same to the province in royalties. One uranium mine could have a similar economic impact.

The statement concluded that *"uranium exploration is not hazardous to Nova Scotia or its citizens and we urge that it be allowed to continue."*

98. VOLUNTARY PLANNING - STATEMENT

Voluntary Planning is an organization which is comprised of more than 450 business people, professionals and other citizens who advised government on long-range policies. Its mining sector was one of 17 sector committees, and that sector had presented a recommendation to the Board which in January, 1982 passed a resolution that the provincial Government lift the moratorium on uranium exploration. The Voluntary Planning Board followed this up with a meeting on March 25, 1982 at which the following participants outlined their views and answered questions.

(40) Susan Holtz - Ecology Action Centre;
(7) Marilyn Manzer - CAPE;
(13) Dr. Don Pollock - Kidd Creek Mines Limited;
(44) Dr. Jack Garnet - Department of Mines and Energy;
(17) Aladar Dory - Atomic Energy Control Board of Canada.

(The meetings they appeared at during the Inquiry are in brackets. R.J. McC.)

The Board went into private session and then made these recommendations (numbering added - R.J. McC.).

1) Uranium mining be permitted in Nova Scotia;
2) It must take into account environmental protection, health and safety of citizens and workers;
3) A "made in Nova Scotia" approach is needed;
4) Comprehensive regulations must be in place prior to mining, and be consistently enforced.

The reasons included " ... *uranium exploration cannot be carried out in isolation from other minerals,*" and a continued moratorium would have an adverse effect on exploration for such metals as lead, zinc, tin, silver, and tungsten. As well, the deposits near Windsor formed a potential uranium mine *"similar geologically and environmentally to many uranium mines in Europe, i.e. France"* which would help to meet a 'made in Nova Scotia' approach.

The Voluntary Board believed that the issue *"must be examined scientifically and objectively, by citizens, government, and organizations so as to discount emotional assertions and thereby base judgments on current fact and technology."* Its members would help to design the Nova Scotia approach.

99. THE HEALTH COALITION OF NOVA SCOTIA - BRIEF

The Coalition, as *"a network of organizations from across the province who are concerned with maintaining medicare and seeking further improvements to the health care system,"* has existed since 1980. Its overall goal was to deal with health issues from a concerner perspective. The presentation was read by IAN JOHNSON.

Health care was not only disease care, but the active promotion and maintenance of the well-being of all. *"We submit that the impact of uranium exploration and processing on the health of Nova Scotians should be the principal basis upon which any decision ... is decided."* Final decisions should be the product of extensive public participation in the Inquiry and in its conclusions and recommendations. Now more consideration was being given to environmental factors (physically such as air pollution and contamination of drinking water, socially such as urbanization and high density of living, industrially such as hazards and practices) in determining the health of people. Improving the environment was one of three major ways in which the health of Canadians could be improved, according to Hon. Marc Lalonde when he was Minister of National Health and Welfare.

The principal concern was for the disposal and management of solid, liquid and airborne wastes, yet *"there is no existing technology which is capable of disposing of uranium mining wastes without requiring human interaction at some point or without preventing inadvertent human contact."* The AECB said there "were still unanswered questions for the long term". The Council felt that any uncertainty, no matter how slight, was a cause for alarm. The Council also noted the presentation of Dr. Phillips earlier of health risks faced by uranium workers.

The Council concluded:

"We therefore recommend that no uranium mining, milling, processing or any other form of uranium development be permitted in Nova Scotia."

MEETING NUMBER SIXTEEN - JUNE 15, 1982

PICTOU

100. THE PICTOU COUNTY WOMEN'S CENTRE - PROGRAM

The Centre is composed of women who have been meeting for more than eight years, and who are concerned with women's health specifically and family health generally.

The presentation was led by COREEN POPOWICH, and included POLLY SZANTOR, KAREN O'HARA, KATHY MacKAY, DONNA MAHHAN and IRENE BRENNAN and children. It included remarks by TONY LAW on behalf of Pictou County Citizens Concerned about Nuclear Arms, which was formed a few weeks before.

The women presented the question *"Would revenues from royalties of Nova Scotia uranium mines be enough to offset higher health costs arising from mining activities?"* There was concern about the long term effects on humans of low level uranium contamination in drinking water.

Ms. Szantor's poem contrasted the fate of children playing on uranium tailings (*"victims of leukemia before they have a chance to live"*) with the alternative energy source, (*"let us turn to the sun and wind and use their gentle strength."*)

The Centre included a 30 minute videotape presentation, "Children in the Nuclear Age", introduced by Ms. MacKay, which featured the views of Sister Rosalie Bertell, who specialized in cancer epidemiology. She was quoted earlier by Ms. O'Hara as noting that *"everyone who is ever going to exist is present now in the bodies of living people. So whatever damage we do to the genetic pool will damage all future* *generations."*

The Centre's presentation concluded with the song "Children's House" by Toni Brown, sung by Donna Mahhan and Irene Brennan (and children?). Its theme is caught in this verse:

"This is no mansion now
Its dust is filling up the sky
We must repair somehow
Or be haunted by our children's cry."

101. ANNE BISHOP - STATEMENT

Four groups endorsed the presentation of ANNE BISHOP, president of Local 135 of the Canadian Seafood and Allied Workers Union. In addition to the Union, these were the Lismore Community Concern Committee, the Umbrella Co-operative Ltd., and the St. F.X. Extension Department. They had been drawn together by troubles in the fishing industry and, more particularly, the ups and downs of the H.B. Nickerson plant, Lismore Seafoods.

She hoped that *"experts who are giving their own time, money and energy to do their research are given more weight than those who are paid to say what they say."* She hoped that the word of experts would not be given more weight than her group.

The three grounds of opposition to uranium mining were: - the release of radiation and the cancer it would cause in this generation and *"who knows what from mutations in our egg and sperm cells"* in future generations; its uses in nuclear electric plants (*"all too often I read that we need nuclear power plants so that we can have all the washers and irons and blenders we want in the future. We don't* *need* *those things. If worse comes to worst, we can establish communal laundries and use the old mix-master another few years"*) and nuclear weapons; and the risks and social costs associated with massive development projects. Few jobs would be provided for local people and not for *"women who pick lobster and crab either ... it gets harder to get unemployment insurance and social assistance because on paper the employment statistics go up."*

102. JANE ROBERTSON - STATEMENT

As a 31-year-old Montrealaise and college graduate who had come to Nova Scotia to become a dairy farmer, she was concerned about uranium exploration and mining. *"In developing a high grade strain of purebred* (Jersey) *cattle, the genetic challenge is great enough as it is, without introducing mutagenic influences, which are an inherent effect of radioactivity."*

She had no doubt that her Jerseys would become an endangered species if uranium exploration and mining were pursued. Radium and radon gas would work into water or the soil, be absorbed by and concentrated in plants, and be eaten by people who are at the top of the food chain. Radium 226 was readily absorbed by alfalfa, *"which is an increasingly popular legume in dairy farmers' forage programs in this area."*

In calling for a ban on uranium exploration and mining in Nova Scotia she asked the question:

"Uranium mining has never been done before in Canada in association with agriculture - why should Nova Scotia be the guinea pig?"

103. DEAN WHALEN

In correspondence with the Inquiry, he indicated that he wished to make a presentation on behalf of a group he identified as Citizens Against A Radioactive Environment. It would include oral and audio-visual components, and would take three hours.

The group does not exist in legal fact, and the speech he made took about half an hour, and consisted of an attack upon the Commissioner and the Inquiry.

104. PICTOU COUNTY VOICE OF WOMEN - BRIEF, SONG

Because Pictou County had a history of industrialization which had gone hand-in-hand with farming and fishing for a number of generations, the presenter, CATHLEEN KNEEN, was sure *"that we here in Pictou County may have some particular insights."*

Uranium is a poison which also gives birth to other poisons. There was a longevity to the poisons for hundreds and thousands of years. *"It was about 80,000 years ago that Homo Sapiens first emerged as a distinct species. We are, then, talking about releasing into the environment a substance which will lose only half of its destructive power over a period of time as long as our entire history."*

There is also its effect upon humans. Marie Curie had died of leukemia so that everyone knew that radiation caused cancer. But only recently were the dangers of low-level exposure to radioactivity realized. *"It only takes one altered cell to cause a cancer ... there is literally no safe level of exposure ..."*

If uranium were an absolute necessity then a case could be made to accept the risk. But world prices were soft and stock piles existed. The radioisotopes needed for medicine can be produced by other means. One could not argue that nuclear reactors were an essential source of cheap energy because, on a cost accounting basis, nuclear plants were extremely expensive to build and decommission, emitted radioactive materials which caused public health problems, and had as their true purpose the creation of raw materials for nuclear weapons. The Pictou County Voice of Women concluded that there should be a permanent moratorium on all exploration for or mining of uranium in Nova Scotia and suggested that the Inquiry *"recommend serious efforts to develop small-scale, environmentally neutral sources of energy for Nova Scotia."*

This presentation concluded with a parody on the song, "Farewell to Nova Scotia." This work is probably familiar to followers of this province's best known chanteuses, Anne Murray and Catherine MacKinnon.

MEETING NUMBER SEVENTEEN - JUNE 22, 1982

BURKE EDUCATION CENTRE, ST. MARY'S UNIVERSITY

Atomic Energy Control Board, the Federal agency, made three major submissions at this and the subsequent meeting of the Inquiry on this date. For convenience of reference elsewhere, the submissions have been given three numbers and attributed to the three presenters.

105. ATOMIC ENERGY CONTROL BOARD - BRIEF

REGULATIONS - A.B. DORY

A 34 page brief by Aladar B. Dory was followed by approximately five times that amount of material which are noted at the end of this digest. He started off by noting that what the Nova Scotian decision would be *"is at this point really not important, but there is one consideration that is very important. Every professional with integrity has to care that when the people of Nova Scotia are making this decision, they are given all the facts."* Experience in Saskatchewan and British Columbia has shown that this kind of inquiry is the best forum to arrive at an objective assessment of complicated and emotional issues.

As a hidden danger, radiation is a risk whose impact does not demonstrate itself immediately, and whose effect will be different on different people. There is uncertainty as to *"the knowledge of the quantitative assessment of the risk of low level radiation exposures. The reason for this uncertainty is that the magnitude of their health effect is very close to the health effects of natural radiation, cosmic radiation and the effects of other carcinogens such as industrial pollution, hydrocarbons from cars and other chemicals we have* *grown accustomed to using."* As far as lung cancer was concerned, tobacco probably outperformed any other substance.

The incidence of lung cancer in miners was studied. The knowledge about radiation was not utilized in the early days of uranium mining. Radon was the most serious source of radiation hazard, and extensive studies of uranium mines in Canada, U.S.A. and Czechoslovakia, fluorspar mines in Newfoundland and iron ore mines in Sweden demonstrated the increase of lung cancer incidence although knowledge of the actual amount of exposure was minimal. He considered that the exposures were generally underestimated. *"It is safe to assume that the concentrations of radon daughters in those mines were such that exposures equivalent to present annual limit could have resulted from working from a few hours to 3-4 days."* The health effects represented a minor portion of total injuries and death.

The work of the Ham Royal Commission on the Health and Safety of Workers in Ontario Mines confirmed an excess incidence of lung cancer among uranium miners.

As a risky occupation, uranium hardrock mining *"is still a less hazardous occupation than coal mining and fishing."*

Mr. Dory noted that fear of the unknown is a basic characteristic. *"It is difficult to convince man of the existence of anything that he cannot see, hear, feel, smell or taste."* The rationale had to be either faith or prior scientific evidence, and radiation caused instinctive fear in most human beings so that their response often became emotional rather than rational.

The acceptability of risks had to be considered in dealing with energy production. A dam failed in India in 1979 and 3,000 died; in 80 years 30,000 coal miners had died in mining accidents in Pennsylvania; there were the accidents in Nova Scotia coal mines. The public wanted electric power and paid the price of 20 - 300 deaths per year from a coal-fired plant (or 200 - 300 from an oil-fuel plant) of 1,000 megawatt capacity according to the Council of Scientific Affairs of the American Medical Association.

"The basic principle in the Canadian regulatory process is, that no risk of radiation (however small) is acceptable if it is reasonably avoidable. The philosophical objective of the AECB is a zero risk." This is not achievable and the closeness of reaching this objective *"is the measure of the social, technical, economical and institutional state of the country."*

In the USA, a survey had been carried out by Decision Research in which three groups were asked to rank 30 sources of risk (alcohol, automobile, smoking, house appliances, guns, nuclear power, etc). The results:

HAZARD	GROUP	GROUP RANKING	ACTUAL
Nuclear Power	League of Women Voters	1st	20th
	College Students	1st	
	Business & Professional Club Members	8th	

Pages 7 - 13 dealt with tailings disposal. In early days of uranium development, waste was dealt with in the usual manner of the mining industry, generally into a lake or other natural depression. Retention structures if required were made from the tailings. The tailings however contained elements which would migrate into the environment, and as a result of *"unfortunate experiences and increased awareness of the society"* there were drastic changes in regulations. The present AECB regulations for uranium tailings *"are the most stringent tailings management in the country"* and additional measures were being investigated. As for the disposal in the long term, the term meant a *"walk away situation where the facility is so constructed that the environment is protected from unacceptable releases of contaminants without the need for constant surveillance or corrective human intervention."* A totally 'walk-away' situation may not be achieved and there may have to be some limitation of the land use.

New technology, site selection, quality construction, and good operating procedures including chemical and physical stabilization of tailings - these would ensure that releases to the environment and radiological exposures of man would continue to be acceptable. In the long term natural erosion forces would almost certainly lead to integration of wastes with the environment. This integration would likely be gradual unless a new ice age came along.

As Mr. Dory noted, it is important that the term waste disposal not be misunderstood, for *"no waste generated by human activity is really disposed of. It is only managed in more or less acceptable ways."*

The contaminant of main concern in liquid effluent from uranium mine-mill facilities is Radium 226 - *"Yet the amount of Radium 226 in the effluent from presently licensed facilities not only meets the limit for Radium 226 in the drinking water, but is meeting or* *approaching the drinking water quality objective which has a number for Radium 226 by a factor of 10 lower than the limit. It is a performance which is not very often achieved by other mine-mill facilities."*

Comparisons were given of other operations - a gold mine-mill in British Columbia, the geochemistry of aquatic sediments from operations on the Moira River system, Ontario, the toxicity from the first radium and uranium mine in Canada at Echo Bay in the Northwest Territories and from other Northwest Territories mines .

Next he looked at radon and radon daughters. Significant concentrations existed downwind in the United States but the problem was not the same in Canada. *"The Canadian tailings are saturated with water,"* which dramatically slows down the radon percolation rate.

At Elliot Lake, Ontario, studies in 1979 and 1980 showed concentrations in Working Levels *"quite significant in close proximity to the source* (which) *quickly diminishes within a few hundred metres."* But an important requirement in close-out would be the need to minimize radon daughter releases and lower the levels of gamma radiation around the tailings.

The Federal law and regulations were next considered. Parliament had passed the Atomic Energy Control Act in 1946, and created the AECB. It was empowered to make regulations:

1) develop, control, supervise and license the production, application and use of atomic energy;
2) control the mining, processing and development of prescribed substances;

3) regulate the production, import, export, transportation, refining, ownership, use or sale of prescribed substances;
4) participate in measures of international control of atomic energy.

It reported to Parliament through the Minister of Energy, Mines and Resources, was comprised of five members including President-Chief Executive Officer, and employed 230 - scientific, technical and administrative. Mining has traditionally been a matter for Provincial jurisdiction in Canada, but in the early days (1946-1975) Board licenses concentrated on security aspects, and left health and safety aspects to the Provinces. AECB now assumes a more direct role. *"The first task of the Board in becoming more directly involved in regulation of uranium mines was to bridge the gap between the comparatively old traditions of the mining industry and the regulatory traditions that had been developed for the rest of the nuclear industry."*

There were seven objectives for radiation exposure:

1) all unnecessary exposure to be avoided;
2) national standards should not be exceeded in operations and should be based on
    a) medical evidence;
    b) epidemiological studies;
    c) *"in the absence of a threshold value in the dose-response relationship, lower objectives based on the best available technology."*
3) all radiation exposures *"to be kept as low as reasonably*

achievable, social and economic factors being taken into account."

4) to achieve 3, emphasis upon the principle of action levels as a practical technical tool in operating nuclear facilities;
5) maximum self-regulation *"to increase responsibility of the management;"*
6) every new practice should be viewed as part of the total occupational hazard; and
7) should be technically [illegible]ified and should result in lowering the radiation exposures.

The AECB's regulatory system rests on the basic assumption *"that there is no absolutely safe limit of radiation exposure below which there are no health affects."* But a zero exposure could not be reached in real life. Hence ALARA (see 3 above) as put forward by the International Commission on Radiological Protection (ICRP). Its recommendations were almost universally accepted.

Mr. Dory noted that there were two extreme approaches to uranium regulation. One would use very extensive and detailed regulations, an autocratic approach which might take away initiative to do better. The other, preferred by the Board, was to set basic objectives and let the company work out the procedures in consultation with the Board, a co-operative approach which would achieve better results in most cases.

The Board's regulations set reporting requirements and exposure limits for its licensees. Regulatory guides were also furnished, though these were not mandatory. The AECB has decided to be more strict because some are not willing to play by the voluntary rules. Among new regulations being drafted were those dealing with ventilation and worker and supervisor education. *"Sins against proper ventilation requirements are among the most frequent violations observed by inspectors."*

Because of the dual interest in regulation of a nuclear facility between Federal and Provincial jurisdictions, a joint regulatory process has been established which has been used for 36 years and has generally worked well. The Federal and Provincial agencies called upon were those dealing with occupational health and safety and environmental protection. There were five steps in the staged licensing process:

1) Ore-removal permit - this is required if there is removal of uranium in excess of 10 kilograms in a concentration exceeding 0.05% grade in one calendar year.
2) Underground exploration permit - this is required for significant excavation work (either surface or underground) and is issued after approval of a safety report and of an environmental impact review;
3) Site and Construction (Development) Approval - this is issued after a detailed environmental impact statement is reviewed and a public information process has taken place. There is continuous review as a facility is constructed;
4) Mining facility operating license - this is issued after the Board is convinced that its regulations will be complied with;
5) Close-out - this is permitted after the licensee shows that

> *"the radioactive waste remaining in the waste management part of the facility will be contained to the maximum extent possible and that the radiation doses to the public resulting from this waste will be as low as reasonably achievable."* Maximum use of natural barriers and minimum reliance on human intervention are factors.

To avoid duplication, informal arrangements with other Federal and Provincial regulatory agencies are made. Inspectors, who may come from provincial agencies, can direct action to remedy breaches and can close down the work areas. AECB has stepped up inspection activities by its own staff. Labour Canada enforced health and safety regulations.

The mine workers are constantly informed, their unions being cut in on all correspondence dealing with health and safety, and having input on licensing guides, proposed regulations and actual licenses. AECB provides experts for workers' seminars. Periodic joint discussions are held. Workers' representatives work side by side with the licensee's technicians in monitoring, having first received special training. A co-operative rather than confrontational approach has resulted.

AECB also enlists a wide range of professional expertise from other Federal and Provincial agencies. It sponsors a Uranium Mine Radiation Safety Course which is given twice a year by the Canadian Institute for Radiation Safety. As for the public, there is access to licensing information. In some provinces where a public consultation process is in being, that will be used; if not the proponent must institute such meetings. There has been a greater flow of information to the media so that sensationalism is not as frequent.

Pages 26 to 29 concerned the nuclear issue and medical doctors. There was criticism of the methods used by two general practitioners at the Bates Commission in British Columbia, who purported to speak for (but perhaps did not) the entire B.C. Medical Association. The Commission concluded, despite the two doctors, *"that uranium mining could be done safely and should be allowed."* The seven year moratorium declared by the British Columbia Government *"was a purely political decision and was not based on actual assessment of the real issues and problems."*

Pages 29 to 33 dealt with radiation health and safety. The exposure hazards dealt with were, in order:

Radon daughters - ventilation systems must be well designed and properly operated; monitoring was being standardized; a personal dosimeter was being developed; a National Dose Registry for miners was kept by the Federal Department of Health.

Gamma - underground this was second to radon daughters and above ground was first in the open pit. The Federal Department of Health had a Radiation Protection Bureau; exposures are recorded in the Registry; the Bureau's full scale personal gamma dosimetry program is now being carried out; extensive shielding and additional monitoring was carried out where there was extremely high grade ore.

Thoron daughters - this is more serious than was first assumed, and *"the determination of the individual thoron daughter exposure will become a regulatory requirement;"* the most effective control was through the ventilation system.

Uranium dust - there was strict containment and operating procedures; enforcement of personal hygiene and protection; monitoring; urinanalysis; *"investigation of the degree of contribution of uranium ore to the total exposure will be the next step in determining the combined exposure of mine-mill workers."*

He concluded with a listing of some of the inquiries and commissions. With the exception of the Newfoundland study involving Brinex Ltd. at Labrador, *"all have concluded that uranium mining and nuclear energy development are acceptable and necessary in the Canadian development scene."* But there is no absolute safety, either in nuclear or other forms of energy produced or used by man.

The brief contained 12 references. It was followed by several useful articles.

"The Biological Effects of Low-Level Ionizing Radiation" by Arthur C. Upton, Scientific American, February, 1982;

"Impact of Past Mining Activities on Aquatic Sediments in Moira River Basin, Ontario" by A. Mudroch and J.A. Capobianco;

AECB documents dealing with public information, and guide to public meetings

'Radiation, - A Fact of Life", and 'How Concerned Should We Be About Low-Level Radiation?", published by the International Atomic Energy Agency;

Reports to the American Medical Association;

Summary of Major Retrospective Epidemiological Studies of Lung Cancer Among Mines in Canada In Which Radiation Is One of the Suspected Carcinogens, by H. Stocker of AECB;

And, Practical Difficulties Related to Implementation of ICRP - Recommended Dose Limitations in Uranium Mines by Aladar B. Dory, AECB.

106. ATOMIC ENERGY CONTROL BOARD - BRIEF

WASTE MANAGEMENT - K. BRAGG

Currently there were about 130,000,000 tons of uranium tailings in Canada, and in 1983 the rate of increase would be 25,000 - 30,000 tons daily. At the outset, according to this scientist, *"older tailings have indeed given rise to some problems"* but *"current practices do allow us to say with some certainty that there is no unacceptable impact from the management practices of tailings."* The three major inquiries in Canada to date were the Environmental Assessment Board hearing at Elliot Lake, the Bayda Commission in Saskatchewan and the Bates Royal Commission in British Columbia. As long as known engineering practices were used with good judgment, there was no unacceptable harm according to each.

The practices of the 50's and 60's were to deposit tailings as a slurry, 30 to 40% solids, but the difficulties were that the dams were permeable and leaked. In early days there was virtually no water treatment and in Ontario particularly, levels of contamination rose to unacceptable levels by today's standards. The current practice is to make dams impermeable, leaking only a little. The low permeability came from clay. If there were a lot of cracks in rocks used for containment, you may have to extend the cut-off down into the rock.

As for water treatment, the water-containing acid, heavy metals and radionuclides - would be treated in tanks by the addition of chemicals. Lime would raise the pH and barium chloride would precipitate the radium. Solid impurities would settle out as a sludge and clean water would result.
In a coning operation, the tailings are mechanically upgraded to some 50-60% solids (instead of 30-40%) with a consistency somewhat like toothpaste. As a deposit it rises at the center like a cone (instead of being high at the edge). Rain water would tend to run otherwise than into the tailings. In a stacking operation, there is also a dam and a valley but little internal dykes instead of a cone. Each would fill up in turn and drain. Both allow the deposit of more tailings on less land, and take you away from the dish system. He also illustrated the sub-aerial deposition scheme, in which a layered structure is created. The very fine tailings at the top would act as a sort of Saran Wrap and much of the water would run

off and not reach the coarse tailings underneath. The under layers could be arranged so that water flows in certain directions. *"This fine-course - fine type of structure is a very good barrier to the radon gas. It acts just like clay."*

The scheme, he noted, was one planned by the Key Lake Mining Corporation in Saskatchewan, and would be the first time it was implemented in Canada. *"Until you actually see it, most reasonable people will keep a question mark in their mind."*

Yet another method illustrated was pit disposal, using a left-over hole from a mine. Because of ground water close to the surface, any hole of this sort would ultimately fill with water. In Saskatchewan, where Gulf was using this method, the uncontaminated water would be kept away from contaminated water by the use of impermeable rock. The water cover itself would be a radon barrier.

Finally there was deep lake disposal, fundamentally the same as pit. Quirke Lake at Elliot Lake was a possible candidate which was 450 feet deep and could contain 500,000,000 tons of tailings and 100 feet of water. This would look after all the tailings that are ever likely to be produced at Elliot Lake. Lake sediments would gradually increase the degree of isolation for the tailings.

Filtration would be used to treat water. Water containing fine particles would be placed in a tank, and pumped through coal and sand. The filter is cleaned by revising the flow - otherwise it would plug up. *"This is an extremely efficient process and some of the data that we've got from systems using this show that you can easily achieve drinking water quality with very little effort."*

In summary, these systems did two things - contained and treated. In terms of efficiency and reliability, *"we're virtually 100% reliable"* on solids, and we can contain liquids *"almost totally but not quite"*. During operation one didn't have to worry too much about radon because *"the tailings are wet and you get a very low release of radon during that period."*

By and large the AECB followed the standards set by the ICRP, as to the levels of contaminants in various situations. The example for drinking water was one becquerel per litre, a becquerel being a unit which is one disintegration per second. In old units, 27 pico-curies per litre. The ideal situation would be one-tenth of that. About a year ago nine treatment systems were surveyed. The standard for liquid mining effluent regulations was 10 pico-curies per litre of dissolved radium, and all nine met the standard for drinking water. Eight of the nine would have met the standard for drinking water of one becquerel per litre, averaged over a month. Seven of the nine would have met the standard of one-third of a becquerel on an annual basis. He expected that Environment Canada would upgrade the metal mining effluent regulations slightly upwards, and would also establish a number for uranium which now did not exist.

The long term management was a big question mark in people's minds. Take small amounts of radiation applied to large numbers of people, and *"you can show that potentially you can get a lot of cancer, but what people fail to look at is how much other cancer comes about, how much other death comes about for other causes."* There was also the large amount of radioactive waste - 130,000,000 tons now increasing at

10,000,000 tons a year. The cost could only be determined by this type or inquiry since social costs and social impacts have to be considered and *"clearly professionals like ourselves in the Board cannot consider some of these more complex social issues."*

The AECB was now dealing with three shutdowns or suspensions of uranium mining facilities - Agnew Lake Mine between Elliot Lake and Sudbury, Madawaska mine at Bancroft, and Eldorado. He elaborated on the latter, because its tailings were the usual type, sand with radionuclides, and there would be scrap from buildings being torn down.

There could be casual access to campsites or golf courses built on tailings because people would not spend enough time to get unacceptable exposure. Long term release was another question. A national research program was underway, to cost $9,000,000 to $10,000,000 over three years, which would collect data, use them to forecast what would be expected to happen on these tailings areas, and deal with disposal technology - how to modify tailings, how to contain them better and how to change their characteristics so that they release less contaminants to the environment.

There were special studies at Elliot Lake on the effect of the loss of radionuclides would have on people. Roughly 80% - 90% would result in exposures to people at the trivial level, representing *"risks that I don't think any sensible person can really pay very much attention to."* But what really controls the sites was the exposures to people living quite close to the tailings, the critical group. *The national program will probably seek to expand on this kind of modelling study."*

AECB had issued a set of interim close-out criteria for public review, which were being revised as a result of public feedback. Most of that response came from industry. The response from the public at large, or non-industry public, *"was almost non-existent, which surprised us."* The industrial response was to prefer fundamental radiation protection principles rather than, as AECB had done, set performance levels or objectives - industry considered this equal to pulling numbers out of a hat.

AECB's staff had worked out an approach, though it had not been adopted by the Board itself. There were three elements:

1) Dose limits specified in the regulations have to be followed;
2) Radiation exposure should be reduced to a level which is as low as reasonably achievable, taking into account economic and social factors - optimization or ALARA. There was a point where the concern would be trivial and about which nobody should be concerned. Obviously that point was debatable. One death in a thousand would indicate a fairly unsafe industry. Starting at one in a million would be considered trivial by most people. The exposure would apply to the critical group.
3) Optimization or ALARA was a highly misunderstood term. One common misstatement was that it is self-regulation on the part of industry. It is in fact subject to any extensive review by the AECB and other government agencies, and

> to the normal regulatory review process. *"It says basically that you spend until the cost to obtain a benefit matches the benefit that you get for that money."*

He ranged through options such as erecting a fence to keep the public away from tailings to removing the radionuclides. *"You look really at the cost per person sievert ... and the Board is recommending a reference range of $10,000 to $50,000 per person sievert ... that would be $100 to $500 per man-rem."* All that one has done is to provide a tool, *"to answer this basic question of how much is enough."* He considered that these fundamental principles, when approved, would be incorporated into a new set of close-out criteria for tailings and would make obsolete the need for performance members. It would be hard to have institutional control for the shortest period of time possible (since this would mean the release of radionuclides in that time period) along with individual exposures that are acceptable. Institutional controls would probably be needed to guard against erosion of dams or other structures, *"but I think to say that that would be at zero degradation is unrealistic at this point in time."* Financial guarantees should protect governments against bankruptcy or involuntary cessation of operations, or against an operator who might operate in bad faith. (There had been one bankruptcy in Canada, but no cases of bad faith operation.)

He hoped that the transition period of close-out would be under federal jurisdiction but be short, say three to five years, in which the Board could impose certain types of financial guarantees, such as a performance bond. Provincial governments should look at the long term. In most cases the land has been under provincial control. Ontario and Saskatchewan had legislation which allowed them to impose a levy on production and set up a fund for monitoring or remedial work. The Saskatchewan model was a good one, because companies would contribute to a long term perpetual care fund, and because the province would take over once the company had conformed to an agreed upon set of criteria. The criteria were necessary because otherwise you couldn't impose a performance bond.

Specific reference was made to the close-out of Eldorado Nuclear at Beaverlodge, Saskatchewan. The written document did not have the concept of the trivial dose as noted earlier because there was no formal agreement, but did include radiation protection principles. The release of radionuclides should not be at a greater rate than during operations. The Saskatchewan Surface Water Quality numbers - *"probably the most stringent one"* - should apply as objectives. There should be maximum use of passive systems - *"you can't run a treatment plant which requires chemicals and constant intervention forever."* The long term performance, a 200 year time frame being reasonable, should be considered for all structures. Gamma fields (direct radiation) should be attenuated to a certain level, and radon should be looked at through optimization. Some tailings spills should be relocated. There should be stabilization of all surfaces against erosion. There should be fairly extensive monitoring. Saskatchewan would accept the site when these criteria have been achieved.

Because of the uncertainty attached to the long term, people asked why licences should be issued. Active control now prevents any unacceptable impact. There is the National Research program. Technologies exist which can deal with major problems from tailings, though they are extremely expensive. And, philosophically, *"it is reasonable to assume that future generations are going to be at least as smart as we are."* He was confident that long-term problems could be controlled.

MEETING NUMBER EIGHTEEN - JUNE 23, 1982

BURKE EDUCATION CENTRE, ST. MARY'S UNIVERSITY

107. ATOMIC ENERGY CONTROL BOARD - BRIEF

RADIATION PROTECTION - W.R. BUSH

Exposure to radiation was the theme of W.R. BUSH, manager of the Radiation Protection Division of the Atomic Energy Control Board. Its purpose was to explain how AECB arrived at its dose limits, and he was critical of some statements of medical doctors previously made to the Inquiry.

"Whether or not uranium should be mined in Nova Scotia is a provincial decision, but if uranium is mined, it is the responsibility of the Atomic Energy Control Board to see that it is done safely." It was concerned with exposure of workers or public to radiation. Man had always been exposed to natural radiation and, since the discovery of X-rays in 1895, to man-made radiation. There was no known threshold dose level below which cancer might not be produced, but there were thresholds for other effects. Above average incidence of cancer was observed amongst groups who received large doses of radiation, such as survivors of atomic bombings of Japan and patients exposed to medical X-rays, and above average incidence of lung cancer was observed amongst uranium miners who inhaled radon daughters *"while working under conditions that would not be permitted today."* It was impossible to determine with absolute certainty cancers that resulted from exposure to low doses of radiation from the greater numbers that occurred naturally and due to other causes.

He used as measurement the millisievert or MSV, equal to 100 rems or as 100 rads for the purposes of his presentation. Everyone of us receives 1-2 MSV every year from natural back-ground radiation, including naturally occurring radioactive substances in the body. *"The claim is often made that the effects of low doses of radiation are not known; however it is known that the effects are very infrequent, in fact the fraction of an exposed population that might develop deleterious effects is so small as to be undetectable. There is no question that the effects are rare; otherwise an above-average incidence of cancer would be observed amongst those people in geographical areas where above-average levels of natural back-ground radiation exist ... there is no apparent connection between cancer incidence and the amount of exposure to natural back-ground radiation."*

He considered various levels of doses:

1) 0.5 - 1 MSV - a low dose received by everyone from natural back-ground radiation;
2) 100 MSV - chromosomal changes may become apparent. The start of the "high dose" range;
3) 250 MSV - lowest dose at which any effect on the body can be observed by ordinary blood tests; changes in the blood are temporary and apparently of no harm;
4) 1000 MSV - would likely cause temporary sickness, but it is most unlikely that such a dose would be lethal;

5) 4000-5000 MSV - would be lethal to about half an exposed group if they did not receive medical attention but if they did it is unlikely anyone would die;

6) 10,000 MSV - an acute dose probably causing death within days regardless of medical attention.

Estimates of the health risk from exposure to radiation have been made by the United Nations Scientific Committee on the Effects of Atomic Radiation and by the International Commission on Radiological Protection. The latter (better known as ICRP) had concluded that if 1,000,000 people each received a radiation dose of 1 MSV to the whole body, there would be ten cases of leukemia and 10 cases of other fatal cancers. (In terms of risk, 1.2×10^{-5} per MSV). The risk of severe genetic damage in that number is four among children and grandchildren, and another four in all subsequent generations. (In terms of risk, 1.6×10^{-5} per MSV.)

To protect against ionizing radiation X-ray workmen were first told not to expose themselves unnecessarily to a direct beam. The first numerical limit was recommended in 1934 to protect the skin and was 1% of the dose required to redden the skin, about 2 MSV per day or about 600 MSV for a working year of 300 days. A limit for radioactive substances in the body was recommended for the first time in 1950 - 3700 becquerels or one-tenth microcurie for radium; whole body radiation was reduced from about 600 MSV to 150 MSV, because of the possibility of cancer and genetic effects. Changes kept occurring, and at present AECB applies the whole body dose limit of 50 MSV and the radon daughter limit of 4 working level months separately, *"such that a miner could in principle receive 50 MSV of gamma radiation plus 4 WLM from radon daughters in a year."* This did not happen in practice, however, because either radon daughters (as at Elliot Lake) or gamma radiation (in the West) predominated. A new value of about 4.8 WLM was being considered for the radon daughter limit.

He was quite critical of those who made the false claim to the Inquiry that ICRP had dispensed with dose limits and suggested ALARA instead. *"It is assumed by the ICRP and by regulatory bodies in general that if a large group of people are exposed to radiation, some of them might develop cancer as a result. It follows that the setting of a limit is tantamount to specifying an acceptable risk, which is a social question."* The ICRP had looked at occupational risks for fatal accidents in industry with a high standard of safety - no more than one per year per 10,000 workers - in setting a dose limit. According to the Bayda Commission, acceptable risks were dependent upon what hazards society is willing to put up with in order to achieve certain desirable consequences. This was the ICRP approach. The occurrence of cancer in occupational groups was greater than amongst the public for uranium miners who were exposed in mines with ventilation that would not be permitted today, but not among Ontario Hydro's nuclear plant or coal plant workers. Their cancer incidence was slightly lower than observed amongst the general public. Because there was much uncertainty in making estimates of the risk of exposure to radon daughters, the ICRP had added dosimetric considerations to its epidemiological approach.

It was very difficult to measure exposure to radon daughters because, inhaled, they remained in the lungs for only a short time before they decay, leaving nothing behind that can be measured. A special unit was invented, that is the working level which is a measure of the concentration of radon daughters in air.

Radium in water was measured by becquerels per litre, the basic occupational limit being 100 per litre, or 2700 pCi. *"If a person were to drink water all year long at that concentration, the radiation dose to his bones would be equivalent in terms of health risk to the risk from 50 MSV to the whole body."* For members of the public the occupational limit was one-tenth. A shortcoming of drinking water guidelines was that they did not take account of the concentration of radioactive substances in food.

AECB proposed to adopt a regulation in 1983 that:

> ... every licensee shall take all measures
> necessary to maintain doses of radiation
> received ... as low as is reasonably
> achievable, social and economic factors
> being taken into account.

This should *"ensure that all reasonable efforts are made to keep doses low, but not so low that people are put out of work because of prohibitively expensive requirements."*

Dose limits had to be observed, regardless of costs; otherwise there had to be a balanced approach. One used this approach in deciding whether to eliminate curves in highways or level railway crossings. *"What is being done is to decide how much money should reasonably be* *spent in order to reduce a statistical risk."*

He put it into uranium mining mining terms, in this way:

> "if it is reasonable to spend $250,000 to $500,000 to reduce the risk of an accidental death, and if the risk of radiation induced fatal cancer is two cancers for every 100,000 people who have each received a dose of 1 MSV, then it would be worthwhile spending $5,000 to $10,000 for every person - sievert of collective dose prevented, or $50 to $100 per man rem."

Other factors such as good practices in other industries should also be followed, and sometimes extra moneys were spent because companies did not want to train and staff additional workers if they could keep some skilled workers under dose limits.

The operations of UNSCEAR and ICRP were explained. The former had dealt with the incidence of Down's Syndrome or Mongolism in India (page 15) which could be contrasted with points made earlier by Dr. W. Thurlow on May 7. The latter drew on the expertise of the world's scientific, medical and health physics communities. AECB itself got medical advice from many different areas, and had an Advisory Committee on Radiological Protection (about half the members being medical doctors) that in turn had established a Subcommittee on Risk Estimates including epidemiologists, medical doctors and biologists. AECB did not have medical doctors on its permanent staff but had one medical advisor in each province.

In the concluding portion, Bush took issue with Dr. Thurlow on several points. *"With the use of the quality factors and weighting factors, very detailed account is taken of the contribution to health risks from all types of radiation."* He thought it was a nonsensical suggestion that drinking water guidelines be replaced by a single value of 2 pCi (0.037 Bg) per litre which would apply to radium, tritium or uranium, because *"a becquerel of radium in the body is a hundred million times more harmful than a becquerel of tritium."* Statements regarding radon had to be considered in light of the fact substances do not behave the same in low concentrations as when present in massive quantities. He pointed to dust particles in the air which could be seen in abundance in a ray of sunshine and which did not settle out.

He concluded, in answer to the question: who guards the public interest? that AECB does and that *"the consensus of informed scientific and medical opinion is that the present standards for protecting against radiation are at least as good as the health and safety standards applied in the safer industries."*

The brief, actually a presentation for which AECB provided a documented version, contained nine references.

108. ENVIRONMENT CANADA - BRIEF

This major presentation, with its 56 page brief, four page bibliography and 19 recommendations, was made by Dr. C.J. EDMONDS, Regional Director General for the Atlantic Region. His major expertise was set out as civil engineering and sanitary engineering, and his minors as biochemistry and nuclear engineering. As a consulting engineer he worked principally in water treatment and waste disposal.

As noted at page 49, prefacing the recommendations, *"Environment Canada neither supports nor rejects uranium mining and milling operations and associated power generation, but recognizes that there are environmental problems to be addressed with them, as with other conventional energy sources."*

The introduction noted that the problem of most concern, in the nuclear cycle, was the release of radionuclides and their radiotoxic properties. The toxicity of most significance to uranium mining was that of several long-lived radionuclides and ammonia. The environment is exposed to radiation from the atmospheric testing of nuclear weapons, the generation of electricity by nuclear power, and from other industrial, medical and related activities that release nuclides, and, in addition, relatively large amounts from natural sources.

"The release of radioactive matter, into the environment presents a special class of environmental protection problem because radiation cannot, in any known practical way, be neutralized or altered from its natural decay sequence, and it can cause permanent, cumulative, or delayed but irreversible harmful effects in all living organisms. Therefore, radioactive materials would require containment during their hazardous lifetime to allay health and environmental concerns."

The local setting influences the designs for mines and mills and their potential for environmental impact. *"In Nova Scotia, the wet climate, generally high water table, and generally acidic waters, may pose* *special problems to radioactive waste management."* Higher than normal concentrations of radium and other contaminants could be released and transported if there were not proper care in site planning, development, operation and abandonment. Pathways analysis of thorium, lead, polonium, radium and radon *"must be performed thoroughly for each site."*

Decisions should be made as early in the planning stages as possible, that is, in prospecting, exploration, design and development. Experience elsewhere (Elliot Lake, Ontario, Church Rock, New Mexico and Uranium City, Saskatchewan) *"underlines the necessity to address long-term concerns, to establish contingency plans for accidental releases, and to address close-out of the mine site during the design phase."*

The brief then noted the constitutional division between federal and provincial governments for the environment. The provinces had *"almost total control over almost all aspects of ordinary mining activity"* but Section 92 (10) (c) of the British North America Act allowed a federal jurisdiction over:

> "such works as, although wholly situate within the Province, are before or after their execution declared by the Parliament of Canada to be for the advantage of two or more of the provinces."

The Atomic Energy Control Act of Canada was passed pursuant to this declaratory power, in 1946. This Act *"placed uranium mining in an entirely different category from that of any other form of mining."* Other relevant legislation included the Fisheries Act, and the Clean

Air Act, and Metal Mining Liquid Effluent Regulations and Guidelines and an environmental code of practice for mines exists. Environment Canada was established by the Government Organization Act of 1970. Its primary objective *"is to preserve and enhance the quality of the environment for the benefit of present and future generations of Canadians. Environment Canada considers that there are no 'safe' levels of pollution, but rather 'acceptable' levels of risk, the determination of which involves social, economic and environmental trade-offs by society."*

Pages 5-19 sorted out the responsibilities and activities carried out among Environment Canada, Atomic Energy Control Board and provincial governments.

AECB and Environment Canada in June, 1981, agreed to consult and co-operate in the development and adoption of standards and objectives for the protection of the natural environment where these relate to the development, use and application of nuclear energy. The responsibilities of the Department would be:

1) assistance and advice on environmental matters;
2) development of standards, criteria and objectives for permissible levels of radioactive and toxic substances in the ambient environment;
3) carrying out the necessary support research;
4) monitoring radioactive and toxic substances outside exclusion zones in cooperation with the Department of National Health and Welfare, the Board, and provincial agencies.

In turn, AECB agreed to such advice from Environment Canada, and considers that advice in carrying out its regulatory responsibilities.

Insofar as the province is concerned, Environment Canada and Nova Scotia have developed working arrangements so that there is a "one-window" approach to industry where both have responsibilities. *"In environmental assessments, cooperation is evident in all phases of project development, including the issuance of joint terms of reference for studies and joint response to the assessment documentation. Generally, the agency having greater responsibility takes the lead or initiative."* It would also be normal to incorporate federal requirements into provincial permits to provide industry with one set of conditions.

Dr. Edmonds dealt with the federal Acts relating to uranium mining and milling:

(1) Fisheries Act - In Nova Scotia the pollution control provisions in Sections 33-33.4 were administered by the Environmental Protection Service (EPS) under administrative arrangements with the Department of Fisheries and Oceans. *"The control levels established are based on best practicable technology ... loosely defined as technically and economically viable technology, as demonstrated by current usage. Economic viability implies that a normally healthy member of the industry can install and operate the necessary technology without undue economic disruption."* This approach is intended to provide a minimum national pollution control standard, but more stringent standards could be set. Amendments in 1976-77 contained new provisions to protect the first habitat that would apply to uranium mining causing disturbance.

(2) Metal Mining Liquid Effluent Regulations - These were passed pursuant to the Fisheries Act and would include uranium mines. Dissolved radium 226 is prescribed as a deleterious substance, the maximum authorized concentration being:

Monthly Arithmetic Mean	Composite Sample	Single Grab Sample
10.0 pCi/1	20.0 pCi/1	30.0 pCi/1

(Each a dissolved value after filtration of the sample through a 3 micron filter.)

Other minerals however are also relevant in considering treatment facilities for uranium mines, and new regulations were proposed June 12, 1982. In addition, Environment Canada was considering the adoption of an objective for maximum uranium concentrations in water frequented by fish of 0.25 mg. uranium 1ℓ, which would also protect aquatic life and water supplies for wildlife. Environment Canada does not favour the unconfined disposal of tailings in either marine or fresh waters, but may approve such *"if the deposit will not significantly affect the fisheries and where on-land disposal presents major difficulties."* Where a small body of water frequented by fish is within the boundaries of a tailings impoundment it may be designated as an impoundment area under Section 5 (2) of the Regulations.

(3) Clean Air Act - No air quality objectives have been developed for radionuclides. Possible areas of regulation exist under Section 7 (specific contaminants deemed

hazardous to health) and Section 8 (guidelines for emission control.) The Nova Scotia Department of the Environment generally used the National ambient Air Quality Objectives.

(4) Environment Contaminants Act - Among the substances regulated are the polychlorinated biphenyls (PCB's) which might be used in a uranium mine.

(5) Canada Water Act - *"Although informal federal-provincial discussions may occur regarding water resources potentially affected by uranium mining activities, it is not anticipated that this Act will be applied."*

(6) Transportation of Dangerous Goods Act - The packaging, labelling and documentation requirements for radioactive goods are dealt with by regulation, but not transportation or handling within the confines of a property licensed under the Atomic Energy Control Act.

(7) Ocean Dumping Control Act - It is unlikely this Act will have any application to uranium mining.

In December, 1973, the federal government set up an Environmental Assessment and Review Process (EARP) to take environmental matters into account at early stages of planning, to assess the effect of projects, and to use these assessments in planning, decision making, construction and operating practice controls. An Executive Chairman and office (FEARO) carried out the work. *"The process of review would be applicable should federal funds be used in the development of a uranium mine or mill or if a development were to take place on federal Crown land."* AECB would first decide whether environmental effects were likely to be significant.

A federal policy on land use had also evolved, and *"through its policies and programs, the federal government's influence extends well beyond federal property."* Dr. Edmonds said full consideration must be given to long-term effects of uranium exploration, mining and milling in Nova Scotia upon agriculture, forestry, wildlife production, recreation and domestic water supply, before a rational decision could be reached. *"Only in this way can the true economic and environmental consequences of uranium mining be properly weighed."*

Several elements of Environment Canada dealt with nuclear related activities, including the Nuclear Program Division of EPS, and the Radiochemistry Laboratory of the Environmental Conservation Service or ECS. On the international scene, the Department participated through the Nuclear Energy Agency, the International Atomic Energy Agency, and the United Nations Scientific Committee on the Effects of Atomic Radiation.

Among its activities were studies on the presence and migration of radioactivity in groundwater near nuclear facilities, behaviour of radionuclides in altered and fractured rocks, predictions of the movement and concentration of radioactivity released to the atmosphere, review of studies on environmental effects of disposal of uranium tailings into deep lakes on the Canadian Shield, and development and operation of a pilot plant to remove radium 226 from effluent.

At pages 19-22 the participation of Environment Canada was noted at other inquiries, in particular Cluff Lake, Elliot Lake (1979), and Bates (1980) where the recommendations and findings relevant thereto were set out.

Dr. Edmonds then directed his presentation (pages 22-37) to environmental aspects of uranium exploration, mining and milling. Special considerations were radiation as an added factor in mining activity, major environmental effects from mining-milling and tailings, and radiological impacts. There was an assessment of the potential impact of uranium mining in Nova Scotia.

Land Use - Short and long-term use impacts of uranium operations should be carefully assessed. *"Without an objective and thorough analysis, the wise use and sound management of our land resources may be jeopardized."*

The primary industries of agriculture, forestry and mining accounted for $239,400,000 or about one-eighth of the gross domestic product in Nova Scotia in 1979, and employed about 18,000. The land resource of Nova Scotia, particularly the low-lands, was capable of expansion. Of the 84% of the forested land of Nova Scotia, about 36% was good forestry land. The provision of recreation and conservation lands was of growing importance. Mining was more site specific than forestry. *"Uranium mining will undoubtedly have some economic benefit; however, development will preclude all other on-site uses for many generations."*

Radioactivity in the Environment - The rate of release of radionuclides would vary because of ore grade, type and the management practices. Those of most concern were Radium 226, Lead 210, Polonium 210, Radon 222 and the thorium isotopes, which might be released in liquid effluent or particulates or gas. Practices of the past have resulted in widespread contamination of surface water around Elliot Lake but effluent treatment methods were now being used at active and inactive sites to reduce the impact.

Environmental Pathways - Radionuclides could be released from tailings by one or more routes - surface or subsurface water, contact of oxygen and water, dissolution by water, the atmosphere, erosion by natural forces and dispersion away from the source, human disruption, animal activity and plant ingress. *"It is essential that these pathways be evaluated and taken into account if a decision is being taken to establish a mining and milling operation."*

Aquatic Pathway - Design, construction, operation and close-out of the tailings impoundment area were important factors in reducing the entry of radionuclides. In Nova Scotia water was used for industrial, domestic and recreational purposes, and this could lend to conflicts - short-term benefits would have to be weighed against long-term use. *"Nova Scotia's environment is characterized by many lakes, numerous streams and a high water table over a large part of the province* (and there could be) *higher mine water infiltration rates and the formation of greater quantities of contaminated mine drainage than anywhere else in Canada."* He noted the high levels of radioactivity found in wells in the Harrietsfield area, where natural sources are considered to be the cause. *"This indicates the general need for extensive baseline studies."*

Atmospheric Pathway - Radon 222 gas, and radioactive dust from the mining process or tailings were the main hazards. Their pathways were inhalation to the lungs, and ingestion of food or water, and could be of concern downwind from tailings sites. They would be dispersed but this *"in Nova Scotia is often hindered by atmospheric conditions which can persist for several days."* Mixing heights were low compared to more continental climates such as northwestern New Brunswick and Quebec *"making for generally poor dispersion characteristics."*

Studies elsewhere showed that radon concentration fell off rapidly with distance, and was almost indistinguishable from background levels beyond 1-2 kilometres.

In Nova Scotia this might not be strictly applicable because of valleys and predominant wind flows. Tailings sites would have to be chosen with care, designed well and properly managed for operation and close-out.

Effect of Radiation on Biota - Sensitivity generally increases with the biological complexity of the species. *"To date environmental protection ... has been effected indirectly through the limit on radiation doses which man may receive."* The detrimental effects were either somatic (manifest in the individual) or hereditary (effect on descendants).

"For stochastic effects, the probability of an effect occurring, rather than its severity, is regarded as a function of dose. There is no lower limit, or threshold, of dose below which a stochastic effect will not occur." And it is impossible to predict which individuals will be affected. *"Risk estimates for stochastic effects in biological systems other than man have not been as well quantified, partly because little is known of the natural incidence of malignancies in key species of the ecoysystem, but mainly because the study of stochastic effects has been of more importance in public health considerations than in ecological protection."*

He dealt with the inhalation or ingestion of radionuclides by organisms. Of particular concern to Nova Scotians was exposure from radionuclides in sediment, since eggs and alevins of salmon and trout are associated closely with the bottoms of streams and lakes for up to half a year. Laboratory studies have shown that single doses of 1,100 rad and above may be lethal to fish, which are the most sensitive group of aquatic organisms, and that dose rates of 1 rad/day and above may cause sublethal somatic and genetic effects in aquatic organisms. "*Significant effects on natural populations have been observed only at dose rates of 10 rad/day and above, although some effects on individuals have been observed at dose rates of 0.5 rad/day and above.*"

There were studies at "average" uranium mines and mills in the United States and the estimated doses were:

63 and 1,200 rad/y to aquatic plants

100 and 350 rad/y to invertebrates

1.1 and 22 rad/y to fish

Most of the doses came from Thorium 230, Radium 226 and Polonium 210. (There might be different characteristics and environmental situation for a uranium mine in Nova Scotia.)

Little was known about somatic or genetic effects of specific radionuclides on birds and small animals.

Non-radioactive Contaminants - Problems might also be presented by nitrogen (some of which might have to be removed to protect fish), acid mine drainage (sulphuric acid having been produced by the action of air, water and certain bacteria upon minerals in uranium ores) and heavy metal contamination (which is associated with the acid problems from some mines). "*Due to the current use of effective waste water treatment practices, acidity and heavy metal releases are not now a* *problem with operating Canadian uranium mines. They could, however, become a problem if the mines were not closed in a proper manner."* Environmental controls at the operational and close-out stages were dealt with by Dr. Edmonds (pages 38-46). Available technology can effectively control most emissions and effluents during operations but *"environmentally acceptable methods of long-term mill tailings disposal which would not be dependent on continued human management have yet to be developed."* From exploration onward there should be measures to minimize the release of radioactive minerals and nitrogen based components.

Controls in Operation - Mine water is generally of a quality that precludes its release untreated to the environment. For uranium mines the general practise in Canada was to route the mine water to the mill; and then to the tailings pond. At open pit mines as much uncontaminated surface water as possible should be diverted from the pit. Aquifers around the pit should be drawn down by a series of external walls. Waste management facility usually consisted of a tailings pond contained by a dam or other structure, and a radium precipitation pond, and most aqueous or atmospheric emissions originated here. *"The effects of tailings seepage on groundwater systems have not been well documented in Canada, but they are now being investigated in the Elliot Lake area."* Over 98% of the radium and essentially all of the thorium in the original mill feed are retained in the tailings impoundment area. $BaCl_2$ was added to remove the radium as a barium-radium-sulphate precipitate ($BaRaSO_4$) in the precipitation pond. Ultimately this can result in the release of Ra-226 into the aquatic environment. Environment Canada was considering the need to control total as well as dissolved Ra-226. Dr. Edmonds said it is noteworthy that one company quite consistently discharges an effluent containing less than 10 pCi/l total Ra-226. A pilot plant project (mechanical treatment plant) had demonstrated that treated effluents containing that level could be produced routinely. As for ammonia and nitrates, the most effective control was to minimize their production.

Radon gas emissions from tailings areas were governed by many factors. Dust releases were minimized by vegetation. Emissions were attenuated by a cover of compacted soil or water.

The close-out phase concerned disposal in an environmentally acceptable manner over a long period of time. Problems would include elimination or reduction of (A) acidic, radioactive and heavy metal laden seepage or leachate; (B) redissolution of radium from $BaRaSO_4$ sludges; (C) dam failures. Samples were given of (A) the nature of untreated seepage from inactive tailings sites in Elliot Lake area, (B) radium leaches from inactive ponds and (C) tailings dams failures in Canada.

Between mine shutdown and implementing long-term disposal techniques, there must be: diversion of surface water or runoff from tailings storage sites; cover or stabilization of tailings ponds surfaces; disposal of $BaRaSO_4$ sludges, perhaps in washed out sections of mines; measures to control radon and particulate releases from tailings; proper siting of tailings containment.

In the overall picture, *"the world has enough coal and uranium to provide energy for centuries. There is time for an orderly transition to a sustainable energy system that does not depend on oil."* Whether fossil fuel (contributing to acid rain), hydroelectric development (altering considerable blocks of land), or uranium (management for extremely long periods of time and some unsolved environmental problems), there were problems of varying magnitudes.

He approached 19 recommendations with the view:

> *"Environment Canada supports strict siting requirements for nuclear facilities and the rigorous monitoring programs associated with such facilities, but is apprehensive about management and disposal of radioactive tailings (large volume-low radioactivity) and spent fuel bundles (low volume-high radioactivity) in the long term."*

. It would be useful *"to identify a primary standard* (for protection of the ecosystem from the effects of radiation) *for key members of ecosystems, to ensure that releases of radioactivity in both the short and the long term do not result in unacceptable risks to populations of these species."* There was no general agreement in Canada on environmentally acceptable "walk-away" condition of the tailings. The presentation concluded with 19 recommendations should uranium mining and milling proceed in Nova Scotia:

1) Environmental impact assessments including estimates of the most probable and worst case scenarios of total release and release rate of major radionuclides during operation and close-out, and predictions of their behaviour and sites of accumulation, and identification of pathways, and estimates of dose rates and their potential effects.

2) Provincial exploration permits specifying sound environmental protection measures.
3) Public hearings prior to development and close-out.
4) Use of atmospheric dispersion modelling techniques to examine distribution of radon and particulates.
5) An environmental monitoring program.
6) Control technologies for the mine be put in place as soon as possible.
7) Tailings facilities designed for the long term.
8) Waste management facilities be planned so that changes can take place to deal with $BaRaSO_4$ precipitates *"in a more acceptable facility and/or sealed within specially designed and constructed settlement/confinement facilities."*
9) Site specific factors be taken into account in deciding on air pollution control facilities.
10) The fisheries be protected by limiting uranium concentration in water to no more than 0.25 mg/*l*.
11) Treated effluent be recycled to the mill wherever possible.
12) Ammonia or ammonia compounds be avoided if technically feasible alternatives exist.
13) Comprehensive effluent and emission monitoring programs be developed on a site-specific basis.
14) Monitor of total Thorium 230, total Thorium 232 and total Lead 210 in their effluents during operation and close-out *"until it has been established that these radionuclides are not present at levels of concern."*

15) Studies by the operator to stabilize the tailings, the objective being to reduce emissions of radon and particulates into the air, and to reduce the mobility of radium and other contaminants in ground or surface waters.

16) Contingency plans be developed by the operator for operation and close-out.

17) Contingency funds be set up by each operator.

18) Industry and government agencies carry out research - separately and jointly - for long term tailings and $BaRaSO_4$ sludge disposal.

19) Ensure public access to information relating to establishment, operation and close-out.

The brief concluded with four pages of bibloigraphy.

MEETING NUMBER NINETEEN - JUNE 25, 1982

UNITED CHURCH HALL, VAUGHANS

Ministerial student MARGIE WHYNOTT opened this meeting with a prayer. The Community is the closest in Nova Scotia to a possible uranium mine.

109. NORMA FLYNN - STATEMENT

Speaking for the first time in public she was terrified but the thoughts of a uranium mine terrified Norma Flynn even more. She was worried about health risks, the uranium site being on the head waters of the Avon River, the problem of tailings disposal, and the transportation of radioactive materials and dangerous chemicals through the community.

"This isn't some community up in the far North like Uranium City. Up there they built the town only because the mine was there and now that the mine is closing they're just boarding the town up and leaving it empty. Here the mine would be dumped in the middle of a community which has existed for a long time and among people who want to go on living here."

People of the area had banded informally into Residents Enlisted to Save Communities from Uranium Exploitation (R.E.S.C.U.E.) and more than 90% has signed a petition asking the provincial government to place a moratorium.

110. BRENDA SELIG - STATEMENT

As the fifth generation of the family started by Harden Rafuse (or possibly his father, making six) BRENDA RAFUSE SELIG was opposed. The establishment of a uranium mine at Leminster Road (outside this area

the geographical identification used is MILLET BROOK) would force the family to leave because *"that mine would be in our backyard."* The mine would last only 10-15 years and the community would be left with a radioactive dump. There was a risk to health. *"Why can't the government come up with an industry which will give our men safe jobs and let us build this community for the future?"*
Mrs. Selig was very upset that Aquitaine had provided samples of crushed mineral containing uranium to children because little children will put everything in their mouths.

111. JACQUELINE SANFORD - BRIEF

Eco-agriculture and uranium mining formed the basis of the brief of JACQUELINE SANFORD, and this farmer presented wind studies from Greenwood and the Halifax International Airport and a detailed map to support her fears.

She noted that much public money was being spent in Nova Scotia to promote agriculture. This would be jeopardized by a uranium mine. Studies had to be completed because *"the effect of low level radiation will show up first in animals because of their higher metabolic and faster reproduction rates. No study has been made, to my knowledge to see if background radiation in Nova Scotia corresponds to areas where reproduction disorders are common."* Elsewhere, in the Southern United States there was premature aging caused by lengthy low level radiation, and in North Australia defoliation and devastation of jungle followed prevailing winds from mine sites. Open pit mining in Nova Scotia would release dust and radon particles.

Mrs. Sanford has been a volunteer statistician for the Atmospheric

Environment Service for 15 years. She described the prevailing winds as South, Southwest, and West in the summertime. Westerly winds would carry particles to the Windsor and Halifax watersheds. South winds would take the particles to Grand Pre dyke farm lands, and Southwesterly winds would cover all of the Avon River and from Falmouth and Windsor through to Noel. The diffusion would take place at harvest time and the livestock would be eating contaminated grass. The costs to farmers to deal with strange new so-called diseases, the compensation required for relocation to cleaner areas, would be "immense" - as contrasted with 10-12 years of doubtful prosperity.

"In Nova Scotia we are looking at three hundred years of land settlement at great cost, in patient work, exchanged for a dozen or so years of doubtful gain and two thousand years of filthy radiation."

112. VIRGINIA REDDEN - STATEMENT

She likened the situation to the use of credit cards, and said the main question is*: "what do we want?"*

113. SYLVIA MANGALAM

Her principal concern was the injury benefits under Worker's Compensation Acts, and her brief - though short - contained 15 references and a bibliography which reflected this concern. Sylvia Mangalam opposed uranium mining because Nuclear power and Nuclear weapons came from it and these are life threatening.

The power provided was not cheap, *"and it leaves behind poisonous garbage that no one knows what to do with."* Monetary reasons to oppose were the boom and bust mining cycle, the alternate uses of the vast amount of capital required, and the threat to existing industries, tourism, agriculture, Christmas trees and fishing - which included the threat by rumour of radiation contamination.

Mrs. Mangalam said that the Worker's Compensation Act, in dealing with uranium industry, should require that *"the industry should pay its way, totally, in relation to its employees and society through adequate provision of injury benefits."* One problem was to keep proper records of radon and thoron daughter exposure and of gamma exposure. There was the resistance by agencies dealing with compensation when effects were not always specific. She thought that compensation should extend to those affected in the vicinity. She was surprised that the Select Committee of the Nova Scotia Legislature had not dealt with the mining of and exploring for radioactive materials, and the January, 1982 schedule of Provisional Assessment Premium Rates had no separate category for uranium mining, milling or exploration. Already her concerns or suggestions were: Silicosis and lung cancer seemed to be *"nearly the only radiation diseases dealt with by the Ontario Board."* There should be a union representative on the Board so that *"the employee and his representatives are the main actors in reporting accidents."*

114. GILLIAN THOMAS - STATEMENT

As a native of Cornwall in Southwest Britain she was of a family that could claim to have lived on Nova Scotian rock for a great many generations. After all before the continents drifted apart millions of years

ago Nova Scotia and Cornwall were joined. GILLIAN THOMAS had previously spoken during the presentation by C.A.P.E. Now she wished to speak on a personal basis as to her objections to uranium mining. The family background was in tin in Cornwall before strip mining of tin began in Malaysia; even now, relatives were engaged in mining on three continents. By birth and upbringing she said she was friend and ally of the mining industry rather than antagonistic. She first encountered the uranium issue when a geologist came to her front door about 1978 to ask for a sample of well water. This provoked her curiousity and she found that Cornwall had rich concentrations of uranium which were not mined because of their proximity to well populated areas. Her opposition developed because she considered that geologists and mining engineers were *"confidently pontificating on radiation and its health effects,"* that the nuclear industry would not acknowledge that uranium is used in nuclear weapons, and the Uranium Institute at its annual September meetings in London concentrated on *"analysis of public opinion and of the anti-nuclear movement."* She reached a point of no return in her distrust.
She recommended a 20 year moratorium on uranium mining, that uranium special licenses be revised to apply to all uranium bearing rocks rather than referring principally to the licensee's intent, and that specific penalties be embodied in the licenses which would be enforced by some specially set up board.
"Twelve references."

115. DONNA SMYTH - ARGUMENT

This presentation took issue with the Kidd Creek presentation made earlier. On the positive side DONNA SMYTH suggested that the Inquiry determine who used what claims, whether they could be sold, and to let the public hear this information. She thought that politicians were less willing than the electorate to educate themselves.

The M.L.A. for West Hants, Ronald Russell was given credit for sending his video tape team to the meeting.

Kidd Creek was criticized because it received more attention for its presentation in the media than the "ordinary citizen", because it did not mention the connection between the uranium industry and Nuclear weapons, because of the international markets, because of the omission of the words "Cancer" or "Carcinogenic" in its presentation, and because it did not address the disposal of barium-radium sludge.

She feared that Nova Scotia was being promoted as a test case -

"if they can get in here, they can get in anywhere."

Her recommendations were for a 20 year moratorium to be lifted only if:

1) there is a technological answer to the problems of long term tailings management:
2) the nuclear threat to the world was no longer:
3) Nova Scotians were consulted and participated in a meaningful way in the decision.

Seventeen references.

MEETING NUMBER TWENTY - JULY 6, 1982

ROYAL CANADIAN LEGION, ANNAPOLIS ROYAL

116. HEIKO PRZYREMBEL - STATEMENT

The Inquiry held its meetings during Nova Scotia's Old Home Summer and waived its usual time requirement that notice be given should anyone be returning to the Province for this fesitval. The presenter was, it turned out, the only one to take advantage of this provision. Heiko Przyrembel of Munchen (Munich) is a semi-retired lawyer and member of a group of seven lawyers, two doctors, two teachers, an economist, two engineers and a musician who own property in Annapolis County. Each of the 15 spends an average of $40,000 yearly in Canada, not including transportation to and from Canada.

He argued that *"it is enough for us to oppose the end uses of uranium we are exposed to at home. We would be stupid to put up with the additional hazards of uranium mining during our vacation summer."* $500,000,000 were brought into Canada by tourists each year, and in 1980, 250,000 Germans visited Canada.

117. JOHN R. TAYLOR - STATEMENT

The President of the Annapolis Royal Board of Trade addressed the Inquiry as an individual who considered that the proposal to develop a uranium mine in a populated area such as Western Nova Scotia was *"a radical departure from the norm."* He concentrated on the economic aspects.

He is a Nova Scotian who had graduated from Acadia University and worked in mines and smelters of Manitoba and British Columbia before returning to Nova Scotia in 1976 to operate an Inn and, more recently, a commercial printing shop.

His work experiences included industrial environment researcher for the Canadian Association of Smelter and Allied Workers and Noise Inspector for the Worker's Compensation Board. He and other businessmen were concerned about the creation of a scar on the South Mountain by open pit uranium mining half a mile in diameter. *"It would certainly not be compatible with our rapidly growing tourism, in which the provincial and federal governments have invested over $2,000,000 in Annapolis Royal these past two years."* There was private investment too.

He saw the problems as being:

1) reluctance of tourists to be within twenty miles of a source of radioactive hazards;
2) reluctance of purchasers to buy produce exposed to contaminated dust;
3) affect on property values near an open pit mine;
4) affect on the South Mountain water shed which supplies all towns in the area. Who would pay the costs of alternative water supplies?

Government subsidies *"are always foremost in the minds of companies wishing to set up operations in the Maritimes ... in this age of envelope financing only so much money is available for economic expansion."* Little would be left for other industries. The cost of site clean up, tailings disposal and other damages would be left to local taxpayers.

Should a mine exist (though he was opposed) there should be proof of financial responsibility and a bond posted to cover the cost of restoring the open pit to its original form, disposing of tailings and maintaining the site until the radiation hazard has disappeared. Would the resultant increase in costs to deal with cancer, threaten health care plans? In regard to Worker's Compensation coverage, he thought there should be a special class, *"so that other types of mining are not penalized by the high cancer rates characteristic to it."*

The precedent had been set in Ontario to accept claims for job induced cancer due to low level radiation. He called upon his work experience to recommend that the 20% of the population who are much more susceptible to industrial health hazards *"be detected and removed from the danger as early as possible."*

Measures to prevent dust from leaving work sites should be required, and it was important to monitor more closely the health of the local population.

He also drew on his experience to observe that less than 10% of the jobs go to local people. It was his opinion that the costs of uranium mining far outweigh any benefits.

118. VALERIE WILSON - STATEMENT

The well recognized difficulties in the management of radioactive wastes were pointed out. VALERIE WILSON considered that the costs would be astronomical and mining companies in Nova Scotia would not be concerned with anything more than a cosmetic treatment.

She presented the views of People for Environmental Protection or P.E.P., formed after the presentation. It was her opinion that *"mining companies will collect huge profits for 17 or so years and leave behind vast amounts of radioactive garbage for the provincial utilities to deal with over the next 100,000 years."*

As for nuclear powered plants, she suggested that much attention had been paid to safety and yet accidents continued to happen. She quoted the Nobel Laureate, Hannes Alfven, that *"if a problem is too difficult to solve, one cannot claim that it is solved by pointing out all the efforts made to solve it."*

The alternatives were conservation, which could be achieved by modest adjustments in lifestyle.

119. URANIUM INFORMATION COMMITTEE - STATEMENT

The Uranium Committee of Annapolis County was initiated during the summer of 1981 by the District Planning Commission on request of Shell Canada, but was to be independent of that commission. It was formed from 15 different sources, but as its presenter and chairman **FRED BARRETT** pointed out, *"those who supposedly favored the uranium industry ceased to attend, followed by those who had no strong opinions or were naturally indifferent."*

Members who were left considered there were 10 advantages should uranium mining develop in Annapolis County. The advantages included jobs, business opportunities, mining profits, broader tax base, cheaper power and greater weaponry.

The disadvantages included pollution, increase of radiation, effects on birth, costs of maintaining abondoned mining sites, international tensions, war hysteria and *"another charge by the Four Horsemen of the Apocalypse - War, Famine, Plague and Death."*

The statement noted that it took almost two years to determine whether a well at Inglisville, located near exploration activity by Shell, was safe. Technology surely would provide in time means for safe waste disposal, which would remove the danger of waste drainage into drinking water.

One of the concerns raised was whether the Emergency Measures Organization in Nova Scotia had plans because Southwest Nova Scotia was directly downwind from Point LePreau. *"Maine has a plan that includes transportation, communication, medical, accommodation, food contingencies."*

[Mr. Barrett is a leading older citizen who used an easel with sheets of paper containing the points he was making. At times he was overcome by emotion and had to pause to regroup his strength. His graphics form part of the material which will be made available to the Public Archives - R.J. McC.]

He considered that *"eventually the whole thing becomes a moral question. Do we want to bring from the lower region a monster that may destroy the earth?"*

He himself did not point the accusing finger at government officials *("in the same quandary in which we found ourselves") or mining company experts ("honest and sincere ... patient and obliging.")* But the committee was concerned *"because the experts on opposite sides find little common-ground. There is a distinct polarization."* The preference was not for those who worked for vested interests.

He concluded that *"the government have laid their yoke"* on the Inquiry and it would require "strength, courage, wisdom and patience."

120. FUNDY AREA CONCERN FOR TOMORROW - PHOTOGRAPHS

F.A.C.T. was one of the groups which supplied members to the Uranium Information Committee. ROBERT BAYS submitted photographs to support his claim that uranium exploration had contravened the guidelines laid down in Nova Scotia. In his view British Columbia guidelines were more stringent.

NOTE: GORDON CAMERON, the oldest presenter (see Meeting Six) returned to read an editorial in "Physics Magazine."

MEETING NUMBER TWENTY-ONE - JULY 7, 1982

ROYAL CANADIAN LEGION, CHESTER

121. LUNENBURG COUNTY DISTRICT PLANNING COMMISSION - BRIEF

The Commission approved the brief at a meeting on June 3, 1982, and four of its five components endorsed its contents - Lunenburg and Chester Municipalities and the Towns of Bridgewater and Lunenburg. The sole recommendation was to support the Moratorium on uranium mining and exploration and to urge the Provincial government to continue it indefinitely.

The presentation was made by Peter Oickle, the planning director. The opposition was based on the risk to health created by leakage into the air, surface and groundwater. *"Even if there is never leakage of radiation from uranium mining, there is the risk that its very presence will have a socio-economic impact which could counter any positive economic benefits."*

Lunenburg County had an environment which many preferred to other parts of Canada or the United States where there was a higher material standard of living, and it was also a tourist attraction. In 1980 tourism was worth $61,750,000 to the South Shore and represented 2,300 direct and 1,200 indirect jobs. The benefits of tourism would last well into the future, while those of uranium mining would one day be gone.

In 1980, the Commission prepared a water resource management study for the County. More study was required to determine the limits and potentials of water resources, and the presence of radiation in groundwater at New Ross has raised many questions including its source.

There should be study as to the susceptibility of water to pollution from uranium mining before any such mining was permitted.

But uranium mining need not be a part of the industrial and economic development of the County which has developed and prospered without it.

122. ROBERT WHITING, Sr. - SPEECH

Mr. Whiting had no formal brief, but his impassioned speech which touched on the Anil plant, cancer, spruce budworms in New Brunswick and "political murder", drew very loud applause.

"I'm a stubborn old bugger, they will not take my guns away."

123. RALPH D. TORRIE - BRIEF

This Ottawa man has been an expert witness at several Canadian inquiries in the soft energy field. RALPH D. TORRIE was the final presenter for Citizens Against Uranium Mining or C.A.U.M. He has written numerous articles on energy and energy policies, and his academic background is Bachelor of Science with honors in physics from the University of Waterloo. His presentation to the Inquiry concentrated on uranium tailings.

First, he contended that *"the uranium market is in a period of near collapse."* There are enormous existing stockpiles, and some utilities such as Ontario Hydro which are paying more than the current market value (because they entered into "basic price, escalated" contracts) will be reluctant to enter into similar contracts. This situation has arisen because *"nuclear electricity is among the costliest energy sources in the world today and is not a rational or cost effective response to rising oil prices."*

He considered that regulation of uranium exploration and of mining would be very expensive because whole new branches of the health, mining and environment departments would have to be set up, needing expert staff and high technology. Could such costs be recovered from royalties from a chemically ill industry?

In most parts of the world uranium mining had taken place in remote areas, with horrendous but largely unseen environmental damage. However, in British Columbia it was considered in an area where important industries - agriculture, fruit growing, tourism and cattle ranching

"Only the strictist and most expensive environmental controls could prevent the eventual downstream contamination of the environment."

The physical processes of crushing and grinding, and the chemical processes of acid leaching, solvent extraction and ammonia precipitations have made wastes more mobile. Tailings were a liquid/solid slurry which contained virtually all of the wastes. Heavy metals might show up in them, such as copper or zinc, at levels that may be of environmental concern. They also contained chemical contaminants such as sulphates and nitrates, and solvent extraction processes polluted them with organics such as tertiary amines, isodecanol and kerosene.

"Tailings masses are complex, dynamic chemical systems. With their newly acquired mobility, augmented by the reagents added in the mill, the chemicals in the tailings react with each other and with their surrounding environment."

Uranium tailings contained thirteen radioactive elements which were not extracted in the mill. Thorium had a half life of 80,000 years and radium 226 a half life of 1620 years.

Not much research had been done on thorium because it was extremely hazardous to deal with.

"Because of the very long half lives ... there is no basis for assuming they will cease to be a potential radiological hazard for the rest of human history on earth."

He would not use the words "management" or "disposal" to deal with the handling of tailings because he did not think there was either enough forethought to justify the former, or worthy practices to justify the latter.

The evidence to the Bates Commission showed no current technology to provide permanent disposal without perpetual human management. It is unlikely that human attitudes and assumptions would reach an acceptable solution. Questions to be answered in selecting the method of disposal included isolation, length of time, integration into the mine/mill complex, budget and the factor of geophysical-geochemical containment or engineered systems.

1) DUMPING - Little if any mitigating technology would be used, possibly crude dams made out of tailings placed on tailings. They had a much higher distress or failure rate than the average for all dams. An example was the use of the Serpent River watershed in the 50's and 60's which provided a public health hazard and the largest single source of radium and thorium pollution on the Great Lakes.

2) MODIFIED DUMPING - This was the approach favoured by regulatory agencies, and included engineered impoundments for surface dumping and controlled and treated discharge of liquid effluents. It might include liners to inhibit seepage into groundwater and coverings to delay erosion and to inhibit atmospheric and surface water contact, and revegetation with grass. But this did not provide the necessary degree of isolation over the long term. Specific examples were given when the new approach did not work:

The Churchrock Tailings Dam - the company did not do what it said it would do, and the inspectors failed to catch this before the dam burst;

Split-Rock water spilled over an embankment;

Elliot Lake - numerous structural failures in dams and dykes, breaks in pipelines, pump failures and unexpected seepage or migration.

Liners from natural clays (such as sodium bentonite or synthetic polymers) cannot be guaranteed for the long term. There were rips or tears when synthetics were installed, or defects. Clay liners might shrink or crack or lose their ability to absorb water. A commercially mixed clay such as

Salena Seal 100 of the American Colloid Company might provide a solution but was expensive. The major problem facing drainage systems was clogging of filters.

As for revegetation, it was not a permanent solution. The Elliot Lake experience was pointed out. Fertilizer had to be added. *"No estimate of potential radioactivity uptake by animals grazing on the vegetated tailings has been made."*

Chemical stabilization had been attempted and failed at several sites. There was no disposal solution in sight for radium-contaminated barium sludge. Environment Canada had said this was not acceptable in the long term.

He saw the current proposals as *"modified forms of surface dumping, representing mild departures from past practice. None of these modified dumping proposals constitute permanent disposal; dispersion is inevitable due to erosion, seepage and failure of engineered systems."*

3) ADVANCED APPROACHES - These included fundamental changes in the nature of the wastes generated, fixation of the tailings, environmental and geological selection of the site, and deep underground disposal. In other words starting with some other assumption than, say, that wastes should be handled or produced in the form of tailings, or that surface dumping nearby was the only alternative.

Underground disposal - this would reduce migration due to erosion or failure of engineered systems, and minimize visual and air pollution.

Solidification - the suggested technique would be to fix tailings in asphalt or cement which would reduce leachability, resist radon diffusion and decrease massive migration.

Radium and thorium separation - there would be a fundamental change in the mill process: If radium and thorium could be removed, all others would take almost a century.

"To extract the radium and thorium in the mill would require fundamental changes in the mill processes. These could include preconcentration of the ore, alternative leachants with radium and thorium separation, and other tailings."

The Canmet laboratories at Elliot Lake, Ontario, had experimented with hydrochloric acid leaching. *"Testing a variety of oxidizing conditions, single stage leaching extracted as much as 97%, 82% and 85% of the uranium, thorium and radium, respectively. By introducing a second stage, targets for both radium and thorium removed were easily met."*

But leaching by hydrochloric and nitric acids raised environmental concerns - the extent to which the chloride ion and hydrochloric acid could be recycled, and nitrate pollution in the effluent.

He did not consider that any of the above constituted permanent disposal but advanced approaches would have to be pursued if permanent disposal is attainable at all. *"One can envisage, for example, radium and thorium removal combined with vitrification, and deep geologic* *disposal of the concentrate. Or perhaps the radium and thorium could be left in the yellowcake - the resultant fuel burnup penalties might even cost less than the separation, vitrification and geologic disposal of the concentrates."*

Industry approached these ideas negatively, because the technologies were not proven, or of uncertain effectiveness or too expensive. But while *"advanced approaches do not guarantee permanent disposal ... if permanent disposal is attainable at all it will only be through (their) pursuit."*

Mr. Torrie considered the costs of disposal:

(TABLE)

Disposal Mode	Total Lifetime Costs ($1000)	Percentage of Price of U308
Dumping	300	0.04
Modified Dumping — Low	5,400	0.60
Modified Dumping — High	7,300	0.80
Below Grade — Open Pit	6,100 - 14,500	0.7 - 1.6
Below Grade — Special Excavation	12,800 - 15,900	1.4 - 1.8
Open Pit — Asphalt Fixation	135,600	15
Deep Mine — Asphalt Fixation	61,050	8
Nitric Acid Leach	87,000	10

"As the table shows, even the most expensive option evaluated costs only 15% of the mill product price." . . . *"as a rule of thumb, to increase Ontario Hydro's calculated cost of nuclear electricity by 10% would require a 75% increase in the price of uranium."*

He next turned to the attitude of the industry towards the disposal question. The public perceived it to have a callous insensitivity to the environment. The industry argued against advanced approaches on the basis of economics rather than *"lobbying for the multilateral improvements in regulations needed to encourage advanced approaches."*

He felt that there was a lack of commitment by government and industry to research and development of advanced approaches to tailings handling. He doubted the capability of the current nuclear regulatory framework. The Atomic Energy Control Board was criticized for several reasons:

> *"virtually idle for twenty years"* before 1974-75 and the report of the Ham Royal Commission;
>
> only five professionals in its Waste Management Division and ten in Uranium Mining Division;
>
> no requirement for regular inspection reports;
>
> no mandatory training or examination of inspectors:
>
> *"no program or plan for ensuring long term or even medium term monitoring of the tailings dumps;"*
>
> no charges laid for violations of the code of practice;
>
> no negotiated solution to the disposal of 85 tons of low level radioactive industrial wastes near Surrey, B.C.
>
> never refused a license;
>
> no rigorous monitoring of performance.

He thought that provincial agencies would do no better because they lacked expertise and attitude.

The brief contains a three page bibliography, several charts, a 1956 letter sent to a tourist operator in Ontario who was concerned about the effect of uranium wastes on his tourist business (he now has moved), and a suggested draft of legislation to cover a seven year moratorium in British Columbia proposed by the British Columbia Union of Indian Chiefs.

In addition to Mr. Torrie, C.A.U.M. had presented several views at Meeting Number Five at Chester on April 30.

Martin Haase explained that C.A.U.M. had been incorporated with 27 members as a non-profit society. IVAN CORKUM (through Mr. Haase), GEORGE GORE, BRIAN McVEIGH, GEORGE PERRY and REVEREND EDWARD TUCK also took part.

Mr. Gore described himself as one able to understand the fundamental principals of geology, nuclear physics or molecular biology, though not an expert. He explored the nucleus of the atoms of various elements, to explain that radioactivity was a description of the release of particles and energy from unstable elements heavier than lead.

It is important to filter radon from the air, being one thousand times smaller than the best filters. He likened the effect of alpha radiation to a bowling ball transmitting its energy to candle pins. *"One single alpha particle collidng with one single D.N.A. molecule can start a fatal cancer."*

The British Columbia Medical Association had calculated that there would be a 40% calculated increase 10 kilometers from a tailings pond, and he lived within 10 kilometers of Millet Brook. This he would not accept.

Mr. McVeigh dealt with the economics because of his background-employment, for example. *"We are being offered the uranium goose that will supposedly lay the golden uranium egg. But do we want it?"* There would be a highly disruptive impact on a hamlet like New Ross, such as inflation, a possible rise in real estate prices over the short term, higher taxes to support a greater infrastructure in the community. Since uranium would be exported the Province would be at the mercy of foreign demand. The fate of Uranium City in Saskatchewan was noted.

Nova Scotia had a flourishing tourist industry with no damage to the environment except wayside litter. The South Shore in 1980 had $33,300,000 worth of the tourist business *"without a doubt this province is committed financially and spiritually to tourism, because it makes a viable economic industry - it's positive, above board, clean, credible and without the need to instigate inquiries."*

Mr. Perry dealt with both moral and practical reasons to oppose uranium mining. Morally *"the uncontrolled and irresponsible use of nuclear weapons by governments or by tourists is a definite possibility. Moreover, the arms race has gone mad."* He recalled the gathering of nuclear scientists, a truly global gathering, assembled by the late Cyrus Eaton at Pugwash in July, 1957. They reached the conclusion after six days that mankind could be annihilated by the misuse of nuclear energy. Since then there has been an alarming spread of uranium weapons.

Mr. Perry then dealt with yesterday's dream of cheap, safe electricity generated by nuclear weapons. Point LePreau's cost in New Brunswick was near three times the original estimate, and Nova Scotia's decision not to participate *"is looking wiser with the passing of time."* Safety and economic problems were plaguing nuclear reactors. He did not argue for a closure of the reactors, but in a period of uncertainty a cautious approach should be used. *"Let us withhold our uranium until we can see it more urgently needed and safely used."*

He noted the secrecy over the nuclear industry, the existence of an international price-fixing ring and considered the industry is a conspiracy. He had been careful, in documenting his statement, to use sources which could not be considered "soft-headed lefties." (There were 20 references in Mr. Perry's brief)

There were no written submissions provided by Mr. Corkum, who was the third generation of his family to operate a water-powered mill which in the long term would provide more stable employment than a uranium mine, or by Reverend Tuck. The latter considered that life was on the skids, and that moral decay was being shown because meetings such as this were held.

MEETING NUMBER TWENTY-TWO - JULY 9, 1982

WELDON BUILDING, DALHOUSIE UNIVERSITY, HALIFAX

124. NOVA SCOTIA FEDERATION OF LABOUR - BRIEF

The position of organized labour was put forth in a brief by the Nova Scotia Federation of Labour.

Its then president, **CHESTER SANFORD**, and his executive acknowledged the research work by **PETER WARRIAN** of the United Steelworkers of America, which represented all unionized workers in Canada's uranium mines for the past twenty five years.

"Our Federation, as well as the labour movement across this country, is not concerned with industrial development or jobs at any price. We are and always have been vitally concerned with safety, social conditions and the environment in addition to just wages and benefits."

At its 1981 convention, the Federation called for a moratorium on uranium exploration, mining and milling until:

1) the health of workers could be protected;

2) the waste products could be contained safely;

3) there were suitable safeguards over the ultimate use.

It also asked for an inquiry that would meet in the counties affected, and *"the intent of the final resolve ... is being met responsibly through the exercise of this Inquiry."*

In looking at the economics of nuclear power, regard must be had to such front end issues of the fuel cycle as mining, refining and waste management, and to the back end issues of waste storage from a reactor and into waste management.

Environmental issues included the safety and health of those in the workplace. *"The uranium mines have taken a terrible toll in workers lives and health."* Any progress over the years came about as a result of confrontation, not of any rational process of scientific enlightment. Workers were also exposed to radon at their homes near mines. Any mines in Nova Scotia would be much closer to populous areas than in Northern Ontario or Northern Saskatchewan. Least understood was the uptake of radionuclides in the food chain.

"We are skeptical in the extreme about uranium mining being introduced to the Province."

In dealing with acceptable risks, one must get input and involvement from the workers, the communities and the general public and not leave them *"to the private preserves of scientists and lawyers."*

The Federation suggested that the report of the Inquiry should consciencously make two preferences - emphasize the need for public attention and discussion of underlying social issues, and err - if there be error - on the side of caution. *"A moratorium that holds back development, if only for a time, is much preferable to a human and ecologized disaster."*

The radiological mining hazards were: excessively high cancer rates for miners; possible genetic damage for the community; for underground miners a synergistic or interactive effect of radon and silica; and nearby, damage from acidity and nitrates. There must be *"extremely stringent regulation of uranium exploration and development in the Province."* These should not be a bar to active promotion of other kinds of mining development.

As to specific risks and issues, worker safety was the first concern. This was much affected by the mining technique. The worker should have the right to refuse work for safety reasons. There was an unresolved jurisdictional dispute between the Federal and Provincial governments in this industry.

After immediate radiation exposure, the biggest single environmental hazard was probably water quality. Air quality problems depended on the waste management techniques used, extensive information was needed on wind patterns and measurement systems. Beyond lung cancer and leukemia, there was a linkage or at least a plausible risk of diabetes, birth defects and miscarriages, mental retardation and diseases of aging from radiation exposure - therefore health profiles for the general community would have to be established.

The biggest and unsolved problem was in waste management. There would be danger for up to 170,000 years. *"Nothing humans have ever built has lasted anywhere near this long. The pyramids and the Great Wall of China are tinker-toy projects by comparison."*

The key issues were containment and exposure principally to air and water. So far the dominant technique was surface storage. Impervious dams were tried. The success of growing grass was far from proven. The use of barium chloride or calcium still left questions as to what happens for the next 100,000 years. *"The more imaginative long-term containment proposals, such as crystals, glass emulsification and synthetic rock are unproven, and recent results are not encouraging."*

Mining ventures should be conditional upon establishment of a contingency fund of $10 per ton of ore, to be held in the nature of a performance bond by government. The money would either be returned or used to fund an environmental clean up.

The final concern of the Federation was with the fundamental question of democracy in a nuclear age. The history of the development of nuclear power was one of secrecy, justified by the argument of national security. This led to control by a small elite, which left workers, communities and public interest groups on the outside. Problems proved to be deeper and more difficult to control, and the industry now functions under a cloud of suspicion. Also, nuclear power cannot be separated from nuclear weaponry and nuclear war.

"One man's finger on a button, with 12 minutes optimum time for a counter strike, cannot be squarred with democratic decision making. This is the underlying lesson, we believe, in the recent wave of huge demonstrations for disarmament. There were many trade unionists and their families in these demonstrations."

Should there be a further inquiry, public funding should be made available for labour, community and public interest groups.

125. PETER WARRIAN - STATEMENT

The director of research for the United Steelworkers, PETER WARRIAN, referred to conditions at Elliot Lake, and set as a yardstick which would satisfy the environmental concerns of the unionists *"when there are fish in Quirke Lake."*

He dealt with standards of water quality, the regulatory questions and the legal right to refuse work because of safety concerns. He considered that France had a good safety record and a good regulatory system.

He thought that the onus of proof should be upon the proponents of those who agreed that uranium could be dealt with safely. Government would be the prime respondent.

As for Workers' Compensation, there could be some improvement - mainly more presumptions favoring the workers - and to mines there could be more monitoring of the alpha hazard.

126. JAMES K. BELL - STATEMENT

Long prominent in Nova Scotia labour, JAMES K. BELL followed the Federation brief with a short speech. He is its Secretary-Treasurer. Most of it was concerned with the use of uranium as a source of energy. Such use could endanger the development of Fundy Power or Sable gas, and hurt research into the emulsification of coal. Furthermore, uranium technology might be outdated if fusion to extract hydrogen from sea water replaced fission.

MEETING NUMBER TWENTY-THREE - JULY 9, 1982

WELDON LAW SCHOOL, DALHOUSIE UNIVERSITY, HALIFAX

127. LABOUR CANADA - BRIEF

The Occupational Safety and Health Branch of Labour Canada set out the Federal position regarding conventional safety and health in nuclear fuel cycle operations in Canada, and complemented information provided by the Atomic Energy Control Board as to their inter-relationship. The presentation was made by J.W. MacLellan, Director, who was accompanied by G. Blanchard and R.G. Butler. The presentation was in six parts (as underlined).

Introduction - *"The production, use and application of atomic energy, including prescribed substances capable of releasing atomic energy, are subject to Federal regulation."* The A.E.C.B. was given authority to issue regulations which included occupational safety and health as they pertained to radiation, and part IV of the Canada Labour Code (administered by Labour Canada) has been declared to apply to the nuclear fuel cycle.

Background - AECB - The background for the Atomic Energy Control Act was explained, and Section 17 detailed. A licensing system was used to deal with prescribed substances, and there was a similar control process for the operation of any nuclear facility. *"For a few years the Atomic Energy Control Board did actively issue exploration permits but this practice was discontinued in 1979."* AECB regulations were primarily concerned with control of ionizing radiation, and when dealing with non-radiation safety and health matters to make compliance with principal regulations a condition for issuing a license.

In 1978, the Canada Labour Code was amended to include provisions for safety committees and the right of workers to refuse to work in situations of imminent danger.

Background - Labour Canada - This Department's mandate, under Part IV, was classified in 1978 as to the role Labour Canada should play in occupational safety and health in the nuclear industry. It takes the conventional (as opposed to AECB taking the radiational), safety and health aspects in the nuclear industry. (The brief showed the role of the United Steelworkers of America in bringing this about.) Because the provinces also in that year had asked that the federal jurisdiction in the nuclear industry be switched back to them, Labour Canada was reluctant to set up a new apparatus which might later be wiped out and in any event seen as bad faith by the provinces. It sought the cooperation of the provinces.

Current situation - administration and regulations - Agreement was reached with Ontario and Saskatchewan that *"Labour Canada would develop an interim program of adopting by reference the applicable provincial mining legislation and would delegate the necessary federal enforcement authority to provincial mine inspectors."* There was a legal contract with the Ontario Ministry of Labour and an administrative arrangement with the Saskatchewan Department of Labour.

Recent developments and future plans - The constitutional discussions produced no changes for the control of the nuclear industry, and proposals were to be made in Parliament for changes in Part IV of the Canada Labour Code. Also, Ontario wanted out because of a shortage of competent inspection staff. Labour Canada accordingly will discontinue the interim approach and proceed with the development of federal uranium mining regulations which it will enforce with its staff, likely by the end of 1983.

Considerations for possible Nova Scotia uranium mining operation - Presuming no uranium mining in Nova Scotia before the end of 1983, the department would do the inspection service from its Halifax or Moncton office. It would continue to work closely with AECB.

128. REVEREND C.R. ELLIOTT - STATEMENT

As a rector of St. John's Church, Fairview, and as a member of the Social Responsibility Committee of the Anglican Diocese of Nova Scotia, Archdeacon C.R. ELLIOTT spoke of the moral issues involved. *"Every Christian, even those who are involved in the scientific research and in the business of mining ... want to affirm very clearly that no decision in any issue is acceptable which does not take values and ethical questions seriously."*

He was pleased that the Provincial government had established the Inquiry. He considered that the report would be balanced and considered because of the academic qualifications, interest in affairs of church and community, and experience of the Commissioner. He was certain that conclusions and recommendations would reflect ethical and social considerations no less than technical and econo-political ones.

His own background included a happy boyhood in New Ross (near the site of a possible uranium mine) and being parish priest for many years.

It was fundamental to man's very existance *"for a creative cooperation between man and his world, nature and human nature."* When there was contention or want of harmony there was human disaster and often natural disaster. The world should be subdued but not ravaged, replenished but not destroyed.

Those in favour of uranium exploration and mining argued it was there and should be utilized, the economy would be boosted, there would be profit and "*employment in critical times*", and scientific and energy benefits to be derived. To some extent costs and risks had been tabulated to show that one could come to a decision in favour of exploration and mining.

He had a two-fold contention to make:

a) The risks and costs have not been tabulated fully. *"To some extent risks can only be assessed over a period of 200,000 years or more;"*

b) An honest and thorough study would include specifically Christian interests and areas of experience - moral-spiritual, doctrinal and pastoral. Their consideration were equal to, or more important than *"the practical considerations around which most of the argument to date seems to revolve."*

We were talking sheer survival as a generation and as a society, *"and as a humanity which is highly sensitive to gross mutation as well as to violent extermination."*

Radiation had increased in recent years through nuclear explosion fall-out, X-rays, and natural radiation through depletion of the cosmic ozone band. *"Enough is enough. While we have the ability to make decisions we must decide against any further radiation risks."*

129. MOST REV. JAMES B. HAYES - STATEMENT

It was a time of some nostalgia for the Roman Catholic Archbishop of

Halifax, for he could look from windows of the Weldon Building upon the very trees which stood outside the home, now gone, of his boyhood. Bishop JAMES B. HAYES spoke in his own name and as Archbishop for the Roman Catholic community in the counties of Halifax, Lunenburg, Queens, Hants, Colchester and Cumberland which make up his archdiocese. Uranium was a substance that in itself was neither good or bad. It had good legitimate and desirable uses in radiation therapy and nuclear medicine, but only a tiny percentage was used for such. *"The production of large quantities of uranium is so intimately linked with issues and practices that are either downright wrong or extremely dangerous that I cannot see any justification for the expansion of uranium mining in Nova Scotia at the present time or in the foreseeable future."* Uranium production could not be considered outside the question of its use in nuclear arms. Many countries now have the atomic bomb and for the most part did so by using nuclear electricity facilities for the purpose of making atomic weapons. Examples were India, Pakistan, and (suspected of such capability) Taiwan and South Korea and Argentina. All were part of Canada's sales record and this country was now seeking buyers in the Middle East. Israel had bombed an Iraq nuclear reactor *"but Israel itself has acquired the bomb by hijacking an entire boatload of uranium off the high seas in 1969 and diverting it to nuclear weapons purposes."*

The risk of war greatly increases as more countries acquire nuclear weapons. *"Until there are meaningful international safeguards in the world to prevent the diversion of uranium for nuclear weapons it is time to declare a halt on the production of uranium for export."*

In a nuclear reactor fuel was converted into highly radioactive particles that would remain toxic for tens of thousands of years - many times longer than human civilization has existed. *"It is our belief that until a safe, reliable method of nuclear waste disposal has been well demonstrated, it is irresponsible to increase the quantities of nuclear waste by mining more uranium."* There were the risks of radioactive contamination and of lung cancer in regular mining operations. Economically uranium prices had fallen and some mines forced to close at home, and reactors were being sold abroad at a loss, and offered at 7% interest while Canadians borrowed at three times that rate.

Uranium mining does violence to all of us and we should put a moratorium on uranium mining *"and find other types of work and economic growth which will enable us to live in peace."*

130. DR. CONSTANCE I. MACFARLANE - BRIEF

As one who did not represent any specific group or organization but was a concerned biologist, Dr. Constance I. MacFarlane said she was *"once greatly interested in the possibilities of uranium"* but now *"deeply concerned about its dangerous effects on health and the environment."*

She did not think AECL or AECB had biologists among their offices. She hoped the provincial government would take advantage of the information provided in public discussion.

Environmental and health consequences or uranium mining were not to be taken lightly, and even exploration could cause unacceptable effects on the surrounding area through trail making, core sampling, and release of radioactive materials in gas or solution in underground water or core holes. *"Good farmland depends on high quality water to prevent soil contamination. Because of the hydrogeology of Nova Scotia, uranium mining could seriously damage the water quality and once contaminated by radioactive and toxic materials released from the ground, the contamination in the aquifers could be irreversible."* Mine water and tailings contained H_2SO_4 and many other chemicals which endanger the water resource.

She referred to attempts to cover tailings by an asphalt-like emulsion and cover of vegetation which in one New Mexican site had been penetrated by gophers which brought tailings to the surface. A polymer emulsion laid down in Arizona in 1968 had almost disappeared by 1980. Vegetation could worsen the problem because some plants have very deep roots which would open up paths to release vegetation. *"Tailings always leak."*

Dr. MacFarlane noted the call by Dr. Rosalie Bertell for baseline studies on community health before uranium mining is undertaken in Nova Scotia. *"She finds that it is not only those who develop cancers and other radiation diseases who are affected. Radiation has been shown to accelerate the aging process and that young people with arthritis, heart disease and diabetes are extremely susceptible to radiation damage."*

With the current conditions and technology available, *"Nova Scotia is far too small a province for uranium mining."* Genetically we should remember that we have not so much inherited the earth from our ancestors as borrowed it from our children. (Eight references and a sketch showing the value of water in simple terms).

131. NOVA SCOTIA DEPARTMENT OF HEALTH - BRIEF

Four senior members of the Nova Scotia Department of Health took part in this presentation. As introduced by C. EDWARD TUPPER, Administrator, the brief would give environmental monitoring data and the position on issues of human health. The Department was "neither a proponent nor an opponent" *"of the concept of uranium resource development in Nova Scotia."* Under the Health Act, the Department has statutory responsibility to prevent the spread of disease and protect human health. Environmental health matters were dealt with by two major divisions - Public Health Engineering and Occupational Health. There were six objectives of the environmental health programs:

1) To develop, maintain and monitor programs, policies and standards in public health engineering, public health inspection and occupational health.
2) To make available to the public, occupational groups, and to industry, a preventive, advisory and consultative service in occupational and environmental health.
3) To establish standards for safe exposure levels to potentially hazardous factors in the physical environment.
4) To investigate, evaluate and monitor hazards to health in the physical environment with a view to their reduction and elimination.
5) To assist and provide expert advice to other government departments or agencies with respect to occupational and environmental health matters which fall within their jurisdiction.

To meet these objectives the Divisions had a multi-disciplinary team of experts and specialists.

The monitoring of radiation in Nova Scotia was explained by TED DALGLEISH who is the Radiation Health Officer.

Since the 1950's the federal Radiation Protection Bureau has taken readings at Halifax, and since 1980, at Digby and Greenwood which are downwind of Point LePreau. *"None of the background radiation levels measured in Nova Scotia have been shown to be in any way health significant."* In 1980, the Bureau made radon measurements in 13 Canadian cities including Halifax and Dartmouth, and the results were consistent with earlier measurements made by the Nova Scotia Department of Health. Radon readings tend to be higher in the winter because doors and windows are closed and fuels release small amounts.

Since 1981 a Radiation Health Advisory Committee has been available to the provincial Department which can guide and advise on the significance and interpretation of data from monitoring.

Occupational health issues, more particularly that relevant to uranium mines, were dealt with by Mr. T.A. MEJZNER, who is Occupational Health Engineer. The miner must contend with *"long term exposures to radiation levels somewhat higher than the normal background. It is currently assumed that there is no absolutely safe level of exposure, and so the issue must be resolved by determining what level above this background is acceptable as a health risk to the worker when weighed against the worker's benefits and the benefit to society as a whole."*

First of all the uranium miner was exposed in breathing to radon, a moderately radiotoxic gas which tends to collect in poorly ventilated spaces; secondly, two of its daughters - radioactive bismuth and lead are highly radiotoxic, and a third, polonium, is very highly radiotoxic. They are primarily alpha emitters and do twenty times the biological damage to living cells as would x-rays.

Then there were particles which could be ingested, and cause liver and kidney damage, and a third pathway into the body was absorption of gamma radiation.

These problems were met by limiting the yearly exposure of miners, by ventilation and dust masks and respirators and filters, hygiene and wet processing in milling.

"In summary, radiation can be accurately measured and the mechanisms for control are well understood and documented."

Exposure for uranium exploration did not exceed normal background activity, and drilling for cores does not account for the release of radon in any significant amounts. (The latter added during the presentation - R.J. McC.)

The final speaker, PETER CASEY, is the Director of Public Health Engineering. He reported on the work of the Task Force on Uranium in Drinking Water, established in 1980, after levels were found in drilled wells in Harrietsfield, Halifax County, which were above the maximum considered acceptable by Canadian standards. But this naturally occurring situation is *"not related to uranium mining activity in any form."*

Water quantity could, however, be affected by man-made activities during milling operations and disposal of tailings. A number of key steps must be observed:

1) Predevelopment monitoring. This should include atmospheric *monitoring and both ground and surface water in areas that might possibly be developed.*

2) *Thorough review of the mining proposal at the preliminary stage. This would include site investigation, initial development details and proposed contaminant and control provisions.*
3) *Design of both short term(life of the mine) and long term monitoring networks.*
4) *Review of final plans, specifications and operations manuals.*
5) *Monitoring of construction and operation of mine, mill and waste management facilities.*
6) *Concurrent with 5, establishment of environmental health monitoring networks.*
7) *Long term health protection provisions for closing out of mine site."*

The brief concluded with a strong recommendation that the Department of Health be involved in the regulating process, by having a direct input to the agencies which regulate and license. This would *"ensure that workers and the public are not subject to hazardous exposures, and that all health protection principals are incorporated into the development throughout the entire development cycle."*

MEETING NUMBER TWENTY-FOUR - JULY 13, 1982

COLCHESTER EAST HANTS REGIONAL LIBRARY, TRURO

132. COBEQUID WOMEN TOGETHER - STATEMENT

The views of Cobequid Women Together, which was founded in 1975, were presented by ENID COOPER. It was described as *"perhaps unique among women's groups in that we are not bound by constitution, formal rituals or geographic boundaries."* Its members came from the communities of the Cobequid Shore.

In the past, it had organized Well Women clinics and sponsored the foundation of the Women's Health Education Network, and public workshops on child development, nuclear power, uranium mining and breast cancer.

The group's main concern was the dangers to health from radiation exposure. Their combined total of 36 children sharpened this concern. They were against junk food in school canteens, and this would be ridiculous if they did not try to prevent their increased exposure to radioactive substances.

Some members were promoting prenatal classes and were alarmed at the rising rates of miscarriages, stillbirths, deformities and long term genetic damage associated with radiation exposure. Many members raised their own food and were concerned about contamination of land and water. Concentration of radioactive substances at the top of the food chain *"is a thought that disturbs women responsible for feeding the broader community as well as their own families."* Their area was, with the Annapolis Valley, the only source of Class II agricultural land in the province. Rivers flowed through it from the uranium-bearing

Cobequid Mountains.

Their own personal safety was also a worry. *"It was a Nova Scotian doctor who first reported the link between radiation and breast cancer in his study of TB patients in this province. It seems ironic that Nova Scotia women should still have to fight against deliberate unleashing of new radiation sources."*

Risks might be acceptable if uranium were desperately needed, but such was not the case. Uranium stock piles for 20 years existed, prices were slumping, mines were closing.

The organization considered that there was a lack of adequate monitoring and regulatory control, and a weakness in occupational health standards. A moratorium was recommended until technology could be developed which would eliminate health hazards.

133. WEST COLCHESTER RURAL DEVELOPMENT ASSOCIATION - STATEMENT

The views of the nine communities making up the WEST COLCHESTER RURAL DEVELOPMENT ASSOCIATION were presented by LORNE PUTMAN for Harry L. McLellan, Chairman of the Environmental Committee. There was opposition to exploration and future mining of uranium in Nova Scotia. The main uses for uranium were in nuclear reactors and weaponry. The former may cost more to dismantle than to construct and there were several near accidents; the latter consisted of at least 50,000 warheads or *"enough to destroy every main city or important centre in the world."*

Environmental problems were noted in the milling and tailings disposal areas, and seepage into water which would affect the fishing industry. *"We strongly urge the moratorium ... be continued until* *at least the end of the 21st century. Hopefully by that time we will be more knowledgeable of the handling of radioactive substances."*

134. CREAM PRODUCERS OF NOVA SCOTIA - BRIEF

Three hundred farmers whose main income was from the farm separation of cream presented the view that *"the uranium industry is an unsafe one"*, through the Cream Producers of Nova Scotia. Their brief was prepared and presented by CAROL FAULISE.

Because the by-product, skim milk had so many uses the cream producers were concerned with the dairy, hog, beef, poultry and grain industries. Farmers depended on "the stringent parameters in which nature permits us to grow food" and to the concerns about temperature and water was added alarm about the increased radioactivity in the environment.

Uranium exploration disrupted the use of land and possibly increased radiation levels. There was, for the farmer, *"no protection if the mining industry seeks to explore for uranium on our land."* And mining *"may render the land useless for thousands of years."*

She was concerned that details of exploration programs would be kept in confidential files for two years, and that farmers might in that period be supplying his herd with radioactive water and selling radioactive milk.

Storage of cores at Wentworth was referred to as an example of non-adherence by the mining company without government action.

The population distribution, climate and geology of the province *"would appear to impede rather than facilitate uranium mining in Nova Nova Scotia."*

As for milling, it required as much water as ore by weight and the discharge would alter natural pathways. Groundwater systems would be further disturbed by excavation of the rock. Surrounding land prices would go down. Dust and radon gas were released at the greatest rate during milling.

After milling, the residue of ore (with 73-85% of the radioactivity present) went into a tailings pond along with chemicals from the extraction process. This was potentially dangerous, and while *"there can be no iron clad guarantee of safety in anything ... this is not a safe system of disposal."* Probably a safe system was not now likely because of the falling price of uranium. Specific examples were given - radium contamination in milk due to contamination of forage from a deserted uranium tailings pile upstream; lack of fish life at Elliot Lake and Church Rock, New Mexico.

The Association requested that the moratorium be continued *"until it has been proven conclusively that uranium mining and exploration is safe."* It also requested that base line studies be conducted by independent institutions, that research be conducted on the effects of low level radiation entering the food chain, that regulations be legislated and enforced to protect and inform the public, and that land use be established giving priority to renewable resources. (Eleven references).

135. NOVA SCOTIA FEDERATION OF AGRICULTURE - STATEMENT

This voluntary organization is supported by 14 commodity groups and has 14 active county federations and 3,000 members for a total membership of 4,000. The NOVA SCOTIA FEDERATION OF AGRICULTURE acknowledged that it did not have the expertise or qualifications to comment on the engineering, environment or genetic implications of uranium mining exploration, but had heard professionals who tried to allay the fears of members.

The policy of the moratorium was supported. *"Further it is our view that a system of data collection should be established to determine base line information and by which to measure changes in the health of plants and animals as it relates to radiation exposure and agriculture."*

Nova Scotia was like British Columbia, rather than the uranium producing provinces of Ontario and Saskatchewan, because of the prospect of mining in areas of major agricultural activity. The Federation would want satisfactory answers to the impact upon plants and animals, the potential cumulative effects of build up in the food chain, and the effects of open pit operations upon the soil, fertility, and agricultural capability.

The continuation of the moratorium was supported until such questions were researched and the results communicated to those concerned, and *"standards to protect both consumers and producers from possible cumulative build-up effects of radioactivity are established."*

The statement also noted that the agricultural industry in Nova Scotia was under serious challenge by imported food, and there would be a potential loss of income and collapse if consumers perceived there was a health hazard in the products from areas of uranium mining.

136. WOMEN'S HEALTH EDUCATION NETWORK - BRIEF

Founded in 1979, the WOMEN'S HEALTH EDUCATION NETWORK consisted of 480 members, had federal funding and maintained an office and resource center in Truro. WHEN had sponsored a Well Woman Clinic project, provincial conferences and workshops. Its main purpose is *"to encourage women to take an active interest in and responsibility for their own well being and that of their families and communities."* The brief was presented by VALERIE EDY.

At its annual meeting in 1981, WHEN reached a general agreement that there was insufficient evidence of the health safety of uranium miniing, and a resolution was passed asking the Provincial government to impose a moratorium on uranium exploration and mining. The meeting of 1982 again voted for a moratorium until the safety of mining and exploration was proven. The brief incorporated the resolution of the Nova Scotia Medical Society, *"that nothing shall be done which would endanger the future health of Nova Scotians,"* passed in November, 1981.

Its areas of special concern were: the release of radon into the atmosphere by disturbing uranium ore, the damage to reproductive cells of women (*"radiation has been shown to cause an estimated twelve percent of all failed human conceptions in North America"*), and the possibility of a predisposing factor towards cancer existing in Nova Scotia, and concentration of radioactivity in the food chain. Its work in educating women in preventive medicine would be undermined by mining operations. Mention was made cf the ethical implications. WHEN would establish an independent agency for environmental study and control of the uranium industry. The Inquiry itself had *"helped build* *a strong network of concerned people all over Nova Scotia, young and old."*

It called for an unqualified ban on uranium mining and exploration, asked that there be public information centres (libraries) all over the province, notice in newspapers of meetings, and funds for public groups *"to bring in medical and environmental representatives for the technical hearings."*

A bibliography and list of resource people were attached.

137. SANDRA F. CREIGHTON - STATEMENT

The suggestion that a referendum be held to determine whether there should be uranium mining in Nova Scotia was one of two points advanced by SANDRA F. CREIGHTON. It could be held when Nova Scotians voted in municipal elections in October.

Ms. Creighton also said that the Inquiry should judge *"the motivations of persons who are for or against uranium mining ... as well as their reasons."* Items to be considered were jobs, tax revenues, profits, a safe environment, and presence or absence of vested interest. Perhaps mining companies and atomic energy agencies should be disqualified in the debate.

She quoted extensively from the book, Understanding Physics: The Electron, Proton and Neutron by Dr. Isaac Asimov (Walker and Company, New York and George J. McLeod Ltd. of Toronto, 1966), to show how radiation sickness develops.

> *"The energy of X-rays, gamma rays or speeding subatomic particles is sufficient, if absorbed by a molecule, to break chemical bonds with the*

> *production of high-energy molecular fragments (FREE RADICALS). These will in turn, react with other compounds. A subatomic particle that is absorbed by an atom may alter its nature, and therefore, that of the molecule of which it is part. If the new atom is radioactive and emits a particle, the recoil will rupture the molecule even if it had survived intact till then. Such chemical changes may well disrupt the intricately interrelated chemical machinery of a cell and upset those systems of reactions that control cellular cooperation. Changes may be induced, for instance, which will allow the unrestrained growth of certain cells at the expense of their neighbours and cancer will result."*

Dr. Asimov continued that the skin, which bears the brunt, and lymphoid tissue and bone marrow which produce blood cells are particularly subject. Leukemia is one of the more likely results of excessive exposure, and killed Marie and Irene Curie. There could be fast or slow death, or mutations in children.

138. ROSS BAKER - BRIEF

Although not an expert in technical fields such as engineering, geology or radiology, his deep feelings on the subject prompted ROSS BAKER to come forward for the first time at a public meeting. He had also written each member of the Legislature and for the first time wrote letters to newspapers twice to state his opposition; much standard ground was covered but some interesting new points were raised.

The uranium mining regulations, or lack of them, concerned him. The first draft of uranium exploration guidelines was started in 1979, several years after exploration started. A second draft appeared March 4, 1981. A further copy appeared Aug. 27, 1982. He considered they were deficient because they did not provide for independent gathering of basic information by government agencies, nor for security bonds. He considered that there was a lackadaisical attitude of government. *"I feel that from the moment exploration licenses were issued the companies should have been subject to stringent and enforceable regulations; the very nature of the mineral involved should have prompted the government to give the public the maximum protection possible."* He followed up his interest by attending public meetings, and listened to experts. The arguments made little or no impact because *"the groups were firmly polarized and remained so. It is doubtful if the viewpoint of anyone in attendance at the meetings was changed."*

The two significant facts which pros and cons agreed on were: radon gas is a potential health hazard and dosimeters were now required (decades after France had made such a requirement) and there is no known way to safely dispose of tailings.

The expression "ponds" merited a closer look in considering disposal of tailings. Most people considered "pond" to denote a small body of water (olympic size swimming pool, skating rink or football field in size) but the description by a mining company executive at Windsor was of something 9-10 acres in size and 30 feet deep.

In this province the (late) Minister of Tourism, Honourable Bruce Cochran, had declared that tourism was our number one resource industry. Uranium mining might have devastating effects on "Canada's Ocean Playground."

He was also concerned about the possible devastation of the Avon River system from any activity at Millet Brook which could reach as far as the clam industry along the Economy shore.

As for economics, there was a very nominal number of jobs of an unusually high risk nature, health wise, for a very short period of time, and the output would be for export. In short, exploitation of a natural resource, with the unsolved problems over the ages of radioactive pollution from tailings ponds.

Uranium was used primarily for nuclear weapons and only a nominal amount was used for electricity. *"The refusal of the government of Nova Scotia to permit the mining of the mineral would be an indication of definite disapproval of nuclear warfare; conversely, the promotion of uranium mining in the province would, by the same line of reasoning, be interpreted as condoning and endorsing nuclear warfare."*

Mr. Baker interrupted his reading to present a tape of a conversation between David Suzuki and Philip Morrison, a scientist who helped develop the first two atom bombs, on the CBC-TV program "The Nature of Things." The responsibilities of scientists were discussed. Morrison made the point that scientists followed the will of people and it was the pacifist Albert Einstein who started the atomic bomb project going.

The issue had emotional aspects. There were two good reasons to justify it. *"First contradictory evidence submitted by the experts on both sides, on the technical aspects involved, is so bewildering and frustrating that individuals cannot possibly arrive at intelligent conclusions."* Second, such causes as abolition of slavery, improvement of working conditions in factories following the Industrial Revolution, responsible government in Nova Scotia, and the Christian religion - emotions had played a vital part in all. As a former Boy Scout, he recalled pleasant camping trips 55 years ago, to the Millet Brook area, and appealed *"nothing will be allowed to pollute that stream"*, to another former Boy Scout, the Commissioner of this Inquiry.

MEETING NUMBER TWENTY-FIVE - JULY 14, 1982

THEATRE "A", ST. MARY'S UNIVERSITY, HALIFAX

139. LESLEY CHOYCE - 1992 EDITORIAL

An imaginative look at what a Nova Scotian editor might write as an editorial in 1992 was provided by LESLEY CHOYCE of East Lawrencetown. The province had turned down uranium mining and *"this concern for the future represents a magnificent turning point in the public awareness of Nova Scotians."*

Familiar, (at least to this Inquiry), issues were mentioned - dangerous technology (described as "dying"), use of renewable or solar resources to provide energy, small amount of usable uranium fuel from *"a very large amount of earth,"* tactics of nuclear proponents, *"massive government investment in major industrial boondoggles,"* pollution to groundwater and use of possible farmland, and whether moral issues should be involved in the ultimate decisions.

Perhaps the concluding lines provide the necessary flavour of Mr. Choyce's essay: -

> *"Nova Scotians had a rare opportunity to direct government action before long term problems were created. They looked down the line to their home province, ten years from then. They saw the chance to opt out of a stagnating era of threadbare technological ideals and they opted for a future of clean renewable energy, higher health standards, and decentralized quality economic development. We commemorate their generous goodwill."*

140. HARRIETSFIELD-WILLIAMSWOOD RATEPAYERS ASSOCIATION - BRIEF

The Association was pleased about *"a comprehensive and open inquiry"* and requested *"to be placed on record as unalterably opposed, without reservation, to the exploration and mining of uranium in the Province of Nova Scotia for all time."* The president of the Harrietsfield-Williamswood Ratepayers Association is WAYNE MUNDLE and research for the 15 page brief was by Mrs. Mona Drabble. There were eleven references, about half being material not hitherto referred. (Harrietsfield is a community with uranium problems in some wells. The Association applied after the deadline to be heard. As a responsible voice for dozens of concerned families the application was readily granted.)

The brief noted that multi-national corporations made decisions about production on global strategies rather than on individual national interests; yet environmental concerns were problems that affected all humanity; and Environment Canada had called for *"Comprehensive studies in the mineral extractive industries would be required before mining could proceed"*, relating to wildlife and humans, vegetation and water.

The late Rachael Carson and her "Silent Spring" (Fawcett Publications, Mc., 1966) had cried a warning against contamination of the environment with *"dangerous and even lethal materials."*

Uranium mining raised issues of the health of miners and others, mistakes in technology, the moral question of cost, radon gas generated from tailings areas for a long period of time; - in brief, *"the scales of humanity will never balance the horrendous heritage we might impose* *on future generations should they survive."*

There were less populated areas of Canada which could provide ore sites if necessary at all rather than *"a tiny province of Nova Scotia."*

Members of the Association executive knew people of New Ross and considered *"we have no mandate to change (their way of life - fishing, picking berries). Morality must enter this debate, therefore let them live in their rightful way in peace."*

The new Charter of Rights and Freedoms was called upon because it provides *"Everyone has the right to life, liberty and security of person" (Section 7.)*

The presentation then turned to *"unbelievably horrible"* health hazards, such as mutations, most of them recessive. Or the living cell under assault by radiation could lose its ability to divide normally, or suffer changes in the chromosome structure. The cell might be killed, or become malignant.

Mrs. Drabble, a retired nurse, wrote in the brief about a doctor-scientist she had met who in 1925 in a New York university was teaching use of the X-ray, without taking precautions. In 1959 at the Royal Victoria Hospital in Montreal he was a patient. *"His vision was impaired, his skin swollen deep pink and raw looking, and covered with skin grafting patches and puffy, so it resembled a painful patchwork quilt of flesh."*

The brief then turned (p. 11) to the phenomenon of uncoupling. Adenosine Triphospate, or ATP, was the universal currency of energy found in all organisms from microbe to man. It furnished mechanical energy to muscle cells and electrical energy to nerve cells. *"The charging of the battery, in which ADP (a diphospate molecule) and a* *free phospate group are combined to restore ATP, is coupled to the oxidative process; the close linking is known as coupled phosphorylatin. If the combination becomes uncoupled, the means is lost for providing useable energy."* Radiation is an uncoupler.

Within the body uranium tends to be converted to the hexavalent uranyl ion. There was some absorption (0.5% - 31%) in the gastrointestinal tract, and once absorbed uranium left the blood to be deposited in tissues, kidney, bones and lungs. Reference was made to the presentation by the Public Health engineer, David A. Grantham, to the Public Health Association of Nova Scotia in 1980, about the chronic poisoning which results from prolonged exposure to low concentrations.

The problem of finding suitable disposal sites was touched upon. There was a growing need as more hazardous wastes developed and more anti-pollution legislation was being enforced. But there was strong community resistance and traditional landfill sites were no longer considered to be acceptable.

In the area served by the Association there was uranium contamination in the drinking water. The Department of Health and politicians had failed to resolve this contamination problem and *"we firmly believe they would be unable to cope with additional matters to uranium poisoning of persons and the environment."* Therefore the resolution noted in the first paragraph.

141. HALIFAX FRIENDS MEETING - STATEMENT

Better known as Quakers, the views of the Halifax Friends Meeting was presented by K. TED SCOTT, the clerk. One of its overriding principles was to oppose violence, and *"we are therefore most concerned about the end uses of uranium - the fueling of nuclear reactors and the fabrication of nuclear weapons."*

The results of uranium mining were being misused - 85% of all U.S. uranium into the nuclear arsenal, the detonation of an atomic bomb by India in 1974, and Argentina as a customer of fuel rods from Canada refusing to sign a non-proliferation treaty, were specifically mentioned.

The Quaker William Rotch was quoted for a remark made in the American Revolution:

> *"I can put no weapon into man's hand*
> *to destroy another that I cannot use*
> *myself in the same way."*

The letter urgently requested that uranium development not be allowed in Nova Scotia.

142. HALIFAX-DARTMOUTH DISTRICT LABOUR COUNCIL - STATEMENT

THE LABOUR COUNCIL of Metropolitan Halifax-Dartmouth was not opposed to uranium mining *"if it can be carried on without risk of damage to the environment or health hazards to those employed in the mining."* The position was given by (then) President RENE QUIGLEY.

It did want a public hearing to be held *"in the future before a mineral claim is issued in this province."* At present a land owner or tenant would only find out by making inquiries on a regular basis. *"The Law requires a public hearing for the rezoning of property and a plebiscite to determine if liquor licenses should be permitted in an area. Surely the issuing of mineral claims should be treated with no less public awareness."* It could be more disastrous than the first two.

The Association concluded that its first priorities were people, *"the preservation of a healthy and safe environment."*

MEETING NUMBER TWENTY-SIX - JULY 16, 1982

DALHOUSIE UNIVERSITY, HALIFAX

143. OXFAM-CANADA - STATEMENT

The Halifax Committee of OXFAM-CANADA was pleased that the Provincial Government had appointed the Inquiry. In 1979 it had participated in the uranium issue by helping the Labrador Inuit Association and by making its statement concerning a possible uranium development in Labrador.

C.J. DOUMA said that his group believes *"that uranium mining is a form of development that benefits a relative few with health hazards affecting many."* The health concern was likened to the need for miners to fight to prove the link between their work environment and their health.

The philosophy of Oxfam-Canada was to favour the same kind of development at home as abroad - full participation of, with maximum benefits to, the local population. The province should opt for a development that does not lay waste to the land or expose future generations to irreparable mistakes. Those extracting uranium were also responsible for its end use. Nuclear power was used in Korea and Argentina, where wage levels and work environments were appalling and anti-union. Finally there was *"the unspeakable evil of nuclear weapons."*

Members of the Halifax Committee are members of the Coalition Against Nuclear War, and took part in the May 30th demonstration in Halifax.

144. LAW UNION - STATEMENT

Its spokesman described the union as representing 40 lawyers and law students. No written brief was presented. The Commission did receive photostats of Section 83 of the Worker's Compensation Act, which deals with radiation as a cause of disablement or death of workers. Where a workman had been exposed to radiation in more than one province, it should not be a burden on him to work out the proportion of payment by each province - the provinces should work out a formula. The right of refusal to work in unsafe conditions should be that of the worker.

145. COMMUNITY HEALTH COMMITTEE - BRIEF

THE MEDICAL SOCIETY OF NOVA SCOTIA

The presentation, by Doctor DONALD C. BROWN, had followed 16 months of study by himself and six other members of the COMMUNITY HEALTH COMMITTEE. Their work was reflected in a resolution, passed without dissent November 1, 1981 at the 128th annual meeting and 17th meeting of the Council of THE MEDICAL SOCIETY OF NOVA SCOTIA.

The principal recommendation was *"that no mining or exploratory drilling proceed until technology has been developed to adequately and acceptably contain (radioactive) contamination"* and the Society offered assistance and cooperation in studies which would lead to protection of health.

In addition to Dr. Brown, the committee included Ian Cappon, Wayne L. Phillips, Allan Pysemany, John Savage, Barry Wheeler and Noel Williams. They had drawn up their report after hearing presentations from many sources including the Chamber of Mineral Resources and Industry, and the Department of Mines and Energy.

The committee considered that environmental assessment studies should be carried out and documented, as to the effects of uranium exploration. *"With rigid regulating safeguards, properly monitored and directed at safety, we can accept that uranium exploration could be allowed to resume without exposing Nova Scotians to unnecessary health hazards."* One safeguard would be filling with concrete and capping all exploratory drill holes. Guidelines should be improved and established as regulations, and legislation should provide monitoring, inspection and exploration procedures which would protect workers and the environment.

The committee noted that finding small amounts of radioactivity while searching for other minerals would preclude further exploration for those other minerals. *"In order that exploration for other minerals may proceed safely there may be room for further modification of regulations."*

While it believed that exploration could be made safe, mining and milling are hazardous under the present state of the art. The risk of lung cancer among uranium miners was greater than among the general population, and probably in time would be even greater because of evidence from studies.

The experience with radon and ventilation was considered, at pages 4 to 7. Studies among Caucasian and Indian workers who had more months of underground uranium employment revealed, *"a significant excess of respiratory cancer."* The conclusion continued that, *"non-malignant respiratory deaths among the (Caucasians) are* *approaching cancer in importance as a cause of death, probably as a result of diffuse parencyhmal (lung tissue) radiation damage. The exposure-response curves for non-smokers are linear for both respiratory cancer and other respiratory diseases."*

The brief then turned to public health and safety (pages 8-9). The areas of uranium exploration claims were very close to major populations and agricultural areas. A circle with a 50 mile radius from Vaughans would encompass most of the population of Nova Scotia, the exact opposite of the situations in Saskatchewan and Ontario. There was no technology to prevent contamination of water or air from tailings ponds which would remain dangerous for over 100,000 years.

The brief concluded with four recommendations which have been incorporated in this digest (environmental assessment regarding exploration, drawing up rigidly regulated safeguards for exploration which should be upgraded from being guidelines to being regulations, and new specific legislation regarding monitoring inspection and procedures necessary to protect workers and the environment). The fifth recommendation dealt with mining. *"We maintain the belief that uranium mining would be an unacceptable health risk for Nova Scotia."*

There are 11 references, figures to show exploration claims, sketches regarding the 50 mile radius point, and the appendices listing the 12 written and oral presentations and 60 additional sources of information.

146. COMMUNITY PLANNING ASSOCIATION OF CANADA - BRIEF

The 20 men and women who form the Board of Directors of the Nova Scotia Division, COMMUNITY PLANNING ASSOCIATION OF CANADA, came from wide ranging backgrounds and most have post-graduate specialties. Their views were presented alternately by JOANNE LAMEY and LESLEY GRIFFITHS.

CPAC was formed in 1946, and has 300 members in Nova Scotia. The Board meets once a month. Its objective is to improve the quality of the environment. Its operation is from a storefront location at 1815 Hollis Street, half a block from Province House, which includes a library, meeting room and referral service. It is a non-governmental organization with financial support from the Provincial Department of Municipal Affairs, used to operate its "Planning Aid" program with community groups.

CPAC welcomed the Inquiry, and to be involved in the process prior to decision. A committee prepared this submission to which membership input was invited. Final approval was given by the Board of Directors. It addressed two issues: regulating mining at home and controlling its use abroad; and, public involvement in the planning and decision making process.

There was controversy over whether technological solutions could guarantee an acceptable level of risk. *"Equally critical is whether we have established the social and political structures and processes which might make the peaceful use of the atom viable."*

Though not addressed, CPAC also believed there should be thorough public debate on the question of whether it is necessary to mine uranium in the first place.

CPAC contended that we do not yet know the full extent of the problems associated with uranium mining, that scientific and technical solutions were not just around the corner, and that it was possible there were no technological solutions to some of the advance impacts.

Could the regulatory system be made to work?

SETTING STANDARDS - permissible levels had been reduced but those set by the ICRP were not submitted to vigorous study or review within Canada; AECB had applied very little money to the front end of the nuclear cycle; the process of setting standards was a closed one and those affected in safety and health should be part of the process.

JURISDICTION - the sharing of the field pre-suppossed that a province had adequate regulatory provisions, but it did not provide clear and identifiable accountability for setting standards, preparing and enforcing regulations; no public scrutiny of important aspects of private negotiations between governments is sought (specifics were not given).

INDEPENDENCE - because the nuclear industry sprang from military needs, there was still a closed shop approach, or secretiveness, even though the country was committed to developing the peaceful atom; the relationship between AECL and AECB was questioned, as was the fact that both report to the same Federal Minister; the industry was heavily subsidized; in provinces the departments responsible for mineral resources usually regulated the uranium industry.

ASSESSMENT - there is at present no requirement *"that a uranium mining proposal undergo full environmental impact assessment."* The approval process does not provide a review of the necessity or desirability of the process.

REGULATORY SYSTEM - public regulations had become the sensible alternative to the old fashioned tort action of nuisance, but *"public regulation tends to cover up the actual costs to society ... we can never be sure that the regulated industry will pay for its own regulations, let alone the costs of unsuccessful regulation."* There was the phenomenon of the regulator adopting the perspective of the regulated. Cooperation was naturally more pleasant than a constantly adversarial relationship.

ENFORCEMENT - the system depends upon deterrence, that is, compliance because of a fear of conviction. The Supreme Court of Canada, in its famous Sault Ste. Marie decision (an unanimous decision, written by Mr. Justice Dickson which divided offences into: (1) mens rea (2) strict liability and (3) absolute liability, the strict liability being almost brand new in Canadian law. R.J. McC), had permitted a defendant to establish that he had acted with due diligence to comply with standards set by regulation.

The CPAC saw this decision as meaning that *"in an industry as potentially hazardous as uranium mining, there is no legal assurance that any of us, in the final analysis, will be protected."*

PUBLIC INVOLVEMENT - regulatory bodies were supposed to be independent watchdogs but the reality was less than this. *"If the regulatory process is to represent the public interest it must closely involve the public."*

INTERNATIONAL CONTROL - this was largely a myth. There was no means of securing compliance with the Non-Proliferation Treaty, as for example, India's nuclear bomb test in the 70's. Bilateral controls were no better, for example, the sale of fuel rods to Argentina by Canada when its (then) military leadership was talking about the development of nuclear weapons.

CPAC then recalled its work in the Planning Act review, and the brief it submitted in January, 1980, which represented over a thousand hours of voluntary work. It said:

> *"It would be unthinkable to proceed with a new development without detailed estimates of technical feasibility and costs. It should be just as unthinkable to ignore social economics and environmental costs and benefits."*

Such impacts should be considered early in planning. Mining operations were mentioned as an area where information was made public to enable effective response.

At the municipal level, the government closest to the people, there was often open arm welcome of mining operations because of the increase of the tax base but municipal governments are in the weakest position to control or regulate these developments.

At the provincial level, citizens could appeal decisions by local councils or the Environmental Control Council to the Municipal Appeal Board, but the process under the Planning Act had become expensive and legalistic, with heavy reliance on expert testimony. The Environmental Control Council only held hearings when requested by the Minister, its findings did not have to be made public, and the final decision was at the discretion of the Minister. And, at the federal level, there would not be automatic review by the Federal Environmental Assessment and Review Process.

The brief included five case studies which concerned requests for public involvement.

Highway 101 (South alignment proponents), rezoning at Kearney Lake (shopping malls and expansion of a quarry), Riverlake (an industrial proposal for the lake serving Fall River, Waverley and Windsor Junction), Harbourview (building and operation of a lead smelter in an older Dartmouth neighbourhood), and Port Hawkesbury (Federal and Provincial planning of a regional growth centre). The last was likened to what happens in mining towns.

The CPAC made two recommendations:

1) that a moratorium be placed on uranium mining in Nova Scotia for a period not less than ten (10) years, and preferably longer, in order to allow time to:
    a) carry out needed research into the impacts associated with the front end of the nuclear cycle;
    b) to investigate alternative forms of regulation; and
    c) to develop opportunities for a public input and

representation into both resource development and the nuclear industry.

2) that the Province of Nova Scotia press for a thorough public inquiry into Canada's Energy policies, particularly with respect to the need for nuclear energy in the light of new research and developments in soft energy path alternatives.

Should there be a further level of hearings, CPAC recommended that

1) adequate funding be provided to public "interest groups",

2) the burden of proof be placed on proponents of uranium mining, and

3) provincial government *"be required to bring forward detailed information as to how they would plan to regulate the industry should it go ahead so that this can be assessed alongside of the scientific and engineering proposals."*

147. HOWARD EPSTEIN - STATEMENT

He felt that the burden to prove safety should be upon proponents of uranium mining, and questioned whether there should be a cost benefit analysis rather than a long-term analysis.

A written brief was promised but not presented.

MEETING NUMBER TWENTY-SEVEN - JULY 23, 1982

O'BRIEN BUILDING, WINDSOR

148. FRED WENDT - STATEMENT

He commented on the motives of those taking part in the Inquiry. A mining company was motivated *"by one sole aim: to turn a profit for the shareholders,"* according to FRED WENDT. It had experts including a lawyer and a public relations person, and put out expensive pamphlets for the householders of Hants County. Those in opposition had doubts and suspicions as to the effects of radiation on the environment but he considered *"their most important reason (was to) realize the consequences of not standing up and opposing an activity which could well destroy our children's future for only a very short term gain for a very small handful of company executives and shareholders."* He contended that any further stages for the Inquiry would be unnecessary.

149. CITIZENS ACTION TO PROTECT THE ENVIRONMENT - BRIEF

The second part of C.A.P.E.'s presentation was made by MARILYN MANZER and DAVID DeWOLFE and included a National Film Board production, in 1978, featuring the chief unionist spokesman for uranium miners of Canada, Homer Sequin. The first part of the brief was presented May 26th.

A mine at Millet Brook or Levy Meadow Brook would be in the headwaters of the major water system serving some of the best agricultural land in Nova Scotia. The prevailing winds blow towards the most densely populated and heavily agricultural areas of West Hants.

DAVID DeWOLFE followed the familiar path of the uranium to lead decay chain, and noted the hazards encountered in mining uranium by the open pit method. *"Kidd Creek Mines would expect to remove 400 tons of ore per day in Vaughans. They may therefore generate 3,200 to 14,000 tons of waste rock daily."*
The mill would have to be at the mine site to be economic - more properly it should be described as a chemical treatment plant.
The familiar hazards were noted in the three states - ore preparation, uranium dissolution and concentration into yellowcake. There was no long range strategy to deal with uranium tailings. Kidd Creek's proposal for a dam would not provide permanent disposal.
MARILYN MANZER said that mining companies were not believed when they said that mining, milling and tailings disposal could be done safely. The medical presentations to the Inquiry were noted.
"Exposure to radiation increases the risk of cancer and of genetic defects." The mortality rate among uranium miners at Elliott Lake was referred to, and an argument made for more epidemiological studies. Kidd Creek had not used the word "cancer" in its submission.
Scientists disagreed as to the conclusions to be reached from the Hiroshima and Nagaski experience. There were serious questions about the reliability of records kept by mining companies.
The brief considered that the study of the effects of radiation on human biology was still in its infancy, but what was available suggested a more cautious rather than a more reckless approach. The brief of the Department of Health was attacked as "ignorant".
C.A.P.E. asked that the final report of the Inquiry include a full

cost estimate to the province of:

1) Maintenance of adequate bureaucratic structures in the provincial departments of Mines & Energy, Environment, and Health required for the lifetime of the mine/s and for subsequent monitoring of wastes.
2) Monitoring costs of tailings areas during the life of the mine/s.
3) Monitoring costs of worker health during the life of the mine/s.
4) Monitoring costs of tailings areas and abandoned mine sites in perpetuity.
5) Health care costs for both mine workers and the general public according to both high and low risk estimates for radiation injury.
6) Cost of clean up resulting from a serious accident such as dam breakage during or after the life of the mine, including costs of agricultural losses.

The brief also noted the pollutants - sulphates, nitrates and amonia - in the waste water which are placed there during uranium extraction. There was no guideline for radium in the waste water. The brief contended that an operating mine at Millet Brook would discharge 100,000 gallons of this daily into the Avon River.

The solid tailings would be deposited near the mill and would present a threat of leaching. They would also produce sulphuric acid.

The disposal of barium radium sludge was a problem for which no acceptable disposal technology existed.

There was nothing in Canada similar to American laws dealing with the closing down of mills.

Kidd Creek Mines had suggested revegetation as part of the solution of long term management, but the brief did not agree with this solution.

Hydrogeology of a tailings site was important, including the natural groundwater underneath. The main geologic feature at Vaughans was granite, in whose cracks and fractures existed water close to the surface and easily accessible to seepage from a tailings dump. The area also had quick drainage through this sandy and gravely soil. The brief estimated that a mine at Vaughans would require 105,000 to 167,000 gallons of fresh water per day plus water that can be recycled. It would use 2,400 to 8,600 gallons of sulphuric acid and 59 gallons of amonia daily, in the production of 400 metric tons of ore.

It was considered that the Avon River would suffer elevated levels of radium 226 lowering of the pH to acidic conditions, high levels of nitrogen compounds which are toxic to fish, etc., and possible eutrophication in standing water.

Other problems were the fears that there would be spills from incoming trucks carrying sulphuric acid, and outgoing trucks carrying yellowcake. An attack was made upon individuals employed by regulatory agencies. Other standard grounds of concern were raised as to jobs, tourism, new demands on community and education services, the creation of disparate levels of wages, and the possibility that a tailings dump would become a site for other dumping.

The audience applauded when the presenter said: *"and modern technology still hasn't figured out how to grow food in the rocks around Halifax. So why are we risking the future of a fertile area so important to Nova Scotia's livelihood."*

In addition to the previous recommendations this part of the brief (which obviously was a rebuttal drawn up in the light of recent briefs to the Inquiry, as noted by its frequent references to the views of Environment Canada) suggested that the Inquiry prepare a draft Act similar to the British Columbia bill proposed by the lawyer for the B.C. Union of Indian Chiefs. It would enable controls to monitor a uranium exploration and mining ban. An article from May, 1981 "Science" on radiation estimates and a bibliography listing 21 sources were attached.

150. DR. MARK KAZIMIRSKI - STATEMENT

As citizen and physician he was deeply concerned about ongoing uranium exploration and projected mining in Hants West. The information and opinion of DR. MARK KAZIMIRSKI was based on his reading and medical background.

Even the most avid proponents would agree there is some risk, and *"as long as there is a reasonable uncertainty that a risk may be present ... (medical doctors felt) there should be an indefinite moratorium in the exploration and the mining until risks are more clearly identified and dealt with."*

If there is no risk, only a few years of uranium mining had been lost, and at a time when there are large stock piles, and Canadian uranium despite rigid controls was being used in the development of nuclear weapons.

MEETING NUMBER TWENTY-EIGHT - JULY 30, 1982

SHELBURNE REGIONAL VOCATIONAL SCHOOL, SHELBURNE

151. GLORIA CORBETT - BRIEF

The thrust of her argument was that there was no technology which could safely deal with exploration and mining of uranium, and it would be irresponsible on the part of the Provincial government to permit such exploration and mining. GLORIA CORBETT said her opposition would continue *"until such time as the standards set for radiation exposure truly reflect what is minimal in risk to health and life, and the proper technology is developed to safely dispose of radioactive tailing and radon emissions."*

The tailings problem was emphasized, and the argument noted new dose levels. She referred to the American studies which showed *" a significantly higher incidence of congenital malformation in areas of high granite rock and shale concentrations containing radioactive minerals, than in areas of basaltic sandstone and limestone."*

This and other studies convinced her that public health organizations and the nuclear industry itself were uncertain about the effects of low level radiation. There was no practical way to stop the release of radon gas from uranium mills. Tailings when buried might be uncovered by erosion over the 80,000 year hazard life of the piles. Provincial guidelines and the Mineral Resources Act were critized for lacking penalties or having a small fine.

152. LYNN NICKERSON - STATEMENT

Her argument was simple - that *"no radiation dose is safe"* - and Nova

Scotia was too small a province for the isolation of uranium mining and the problems of dealing with tailings.

Lynn Nickerson concluded that *"the money required to provide adequate food, water, education, health and housing for everyone in the world has been estimated at seventeen billion dollars a year - about as much as the world spends on arms in two weeks."* Her statement was read by JENNIE LAMONT.

153. KATHLEEN TUDOR

Most of her argument concerned the problems associated with nuclear reactors that produce electricity, but some new points were made in dealing with the usual concerns by Kathleen Tudor.

The concerns were health, social danger in communities, psychological effects from fear.

Elaborating on this last point, she noted that farmers and fishermen could feel pride in contributing to the welfare of humanity by producing food. Uranium mines could not have such comforting reasons *"which will do little financially for them in the long run but which may destroy the values, even the very society in which they are trying to make a living."* There were also the fears to be considered, *"by the possibility of contaminating the environment."*

The anxiety symptoms in people living near the Three Mile Island reactor were noted, and the increased use of alcohol and tranquilizers. A federal court had ordered psychological surveys before unit I could be started up again. Ms. Tudor noted the health problems from environmental pollution in addition to anxiety and varieties of mental illnesses.

As for the job, menial ones would go to Nova Scotians and only a negligible number would be employed in the professions involved. She considered experts were unreliable and critized the guidelines. *"They are some guides to behaviour, they are not law that can be enforced."* She concluded her position of opposition with her view, *"I am unable to accept the assurances of the government and the mining companies because too often they have misled and misinformed the public about the dangers of various enterprises."*

154. ANNE SMITH - BRIEF

This well documented brief, with eight references, was prepared by ANNE SMITH and read by her sister LEONA SMITH. New expression was given to the matters generally raised, because she found that *"although repetition is sometimes of value, in this instance the subject is so vast and varied that there is no need for duplicaton."* She thanked the Atomic Energy of Canada Limited for providing her with dozens of reports on request. Uranium was followed from its discovery in 1789, its ore being used as a source of radium in 1898 by Marie Curie when it was considered *"a laboratory curiosity - a chameleon that changed into other elements as it decayed"* and therefore useless, and then to the 40's and its use in nuclear weapons - *"perhaps the blackest chapters ever recorded (in history)."* She was concerned about the growing gap or perhaps a wedge between decision makers and the people. The Inquiry was welcomed because it promoted awareness and participation, and recognized the people fact.

An incident of concern was the seismic testing off shore, for a site for undersea dumping of high-level nuclear waste. There was mineral activity in sections of the county, but a refusal to let citizens know what was going on. Reference was made to:

1) the consideration given in 1973 to the possible construction of a nuclear power plant on Stoddard's Island which would feed New England by underground cable;
2) exploration for minerals at two Green Harbour peninsulas which were declared to be Crown lands, thus easier to prospect than if individuals had to give permission;
3) the studies by the research vessel Hudson, East of Bermuda, in the Sohm Abyssal Plain, to provide a nuclear waste dump. *"Do we really need this complicated pyramid of technology? Or are we to become the garbage can of the world?"*

The nuclear reactor in the backyard, a waste dump, land ownership "swept under the Crown rug, or a pool of mill tailings in their neighbourhood" were mentioned. Ms. Smith concluded:

> "If any of these atrocities are accomplished, however, without consultation, then it is logical to assume that eventually, there will be outright war."

155. **ROBERT S. SMITH - STATEMENT**

He considered the Inquiry was a brave chapter in the history of the province, because a public forum would determine the best interests of the people. Civil courage, dedicated learning and able submissions had been shown, according to ROBERT S. SMITH. Those employed in mining faced a very emotional issue, *"perhaps because the Three Mile Island incident burst the myth that caution and safety accompanied all things radioactive."* He considered that the present science was in its infancy.

He considered five areas in weighing pros and cons:

1) JOBS - uranium workers were employed elsewhere - how many trained and qualified uranium miners existed in Nova Scotia?

2) REVENUE - the market was soft and large stockpiles existed. *"Can there be any reason to believe there will be an especially heavy demand for low grade Nova Scotia uranium?*

3) SPIN OFFS - one was the sale of heavy water from Cape Breton plants, but these depended on sales abroad of CANDU reactors. Also, about 29,000,000 was being spent anually in experiments to deal with radioactive waste disposal, and this expense must fall mainly on taxpayers.

4) EXPORTS - Nova Scotian's uranium would be destined for export since the Province is not committed to nuclear power. He likened the situation (export of yellowcake, retention of radioactive wastes) to our lands being leased to a foreign power which would take the crops and leave the effluent to be buried in septic tanks.

5) FUTURE PROSPECTS - No new plants were being opened. Would there be a viable market in five years?

He concluded that Governments must respond to the concerns of groups concerned about hazardous programs. *"The actions of government are like a walking elephant. When one misplaced step can have such serious consequences to those who are under them, governments must move with extreme caution."*

A secondary defence would be for environmentalists and historians to play a greater role in up-coming Council elections.

156. JAMES SPENCER - BRIEF

He was primarily concerned with the geology and watershed of Shelburne County, but JAMES SPENCER considered that his remarks could apply to Queens, Yarmouth, Digby and Annapolis Counties.

About 90% of the soils of Shelburne County have developed from glacial drift, which is shallow. *"Water percolates rapidly through these materials and the soils tend to be droughty."*

Radioactive material could be leached from one area and not surface until it hits a drainage system or a well.

Fifteen typographical maps (1:50,000) showed an immense and intricate drainage system. There were five major drainage systems serving the 993 square miles making up Shelburne County - the Sable, Jordan, Roseway, Clyde and Barrington Rivers, and it *"is very conceivable that many drainage systems are interconnected by underground water passages."*

If a mining operation were to take place in the Tobeatic Management area, the watersheds of all Nova Scotia, west of Route 10 could be contaminated. All inland water emptied into rich salt marshes and the environment. The fishing could be destroyed by pollution or by a rumour or market scare of contamination.

Should mining be allowed, the Provincial and local governments would have no say.

"Would you put the safety of your children in the hands of an inspector from the Atomic Energy Control Board knowing the results of the Elliot Lake region?" The only other protection would be from the mining companies, but since there was no technology to solve the tailing problem no sensible person would rely on such protection.

MEETING NUMBER TWENTY-NINE - SEPTEMBER 7, 1982

COLLEGE OF CAPE BRETON

157. DR. ALBERT MAROUN - STATEMENT

As a scientist and engineer, DR. ALBERT MAROUN made three major points. In 30 or 40 years would people look back and say *"God, these people were fools to have let this happen."*

Firstly were large power plants, nuclear or otherwise, desirable or necessary? Their costs were exorbitant, and their distribution systems elaborate and sensitive to disruption which could lead to blackouts and brownouts. Alternative ways to produce power must be explored. (As an aside, he felt that lack of good food producing land might become the most major problem, not the lack of power.)

Secondly, *"all mines are a mess"* but where mining of nuclear materials was concerned there was nuclear waste such as radon gas added to the usual mess.

Thirdly, the President of the University of the College of Cape Breton was concerned with the harmful health effects from exposure to radiation. Statistics showed that persons exposed to fallout from nuclear testing experienced higher mortality rates and birth defects in their offspring. Dr. Maroun had worked at the University of Toronto between 1953 and 1956 with radioactive tracers. A fire in the laboratory resulted in the spread throughout the building of nuclear wastes that were collected and dumped. In reference to his Ph.D work at that University, he remarked *"if I had known then what I know now about radioactive material I would have stayed away from the whole bloody project."*

158. CAPE BRETON CO-OPERATIVE COUNCIL - BRIEF

The Council argued that uranium development would lead to greater unemployment and greater regional disparity. As put forward by JOHN CHISHOLM for the council, uranium development *"creates unemployment in that it takes people out of sustainable employment for a short period of high wage employment and then leaves them unprepared to return to their former employment."*

Nova Scotians had sustained lifestyles built around small communities. This led to a community spirit and a penchant for co-operative enterprise. Uranium mining, by its short-lived nature, would destroy communities. Cape Breton was close to self-sufficiency in the 19th Century and exported food, however the steel and coal industries changed that by creating, along with industrial employment, the urban poor and a dependence on others to provide basic necessities, and a petering out of rural communities. Now there were unemployed who were a generation or two removed from agriculture and unable to return to their former way of life.

Mining developments of very short duration had scarred the landscape and people of Cape Breton - for example, gypsum workings at Dingwall, Cheticamp, St. Ann's or Malagawatch, base metal mining at Sterling and Loch Lomond. *"Most have failed because of market conditions over which we have no control."*

In all cases good agriculture and forest land were destroyed. Philosophically labour should be meaningful to man, who *"should be able to perceive (that) the end result of his labour (was) productive."* Uranium was not.

While the brief did not deal at length with health hazards, the point was made that exploration and mining should not proceed while there is a reasonable doubt of the hazardous effects on humans and animals.

159. RONALD J. MacEACHERN - SONG AND STATEMENT

Radium and radon were released into the environment when yellowcake was produced, and *"both are highly carcinogenic. They cause leukemia, lung cancer and bone cancer."* The noted folk singer, RONALD J. MacEACHERN, made his argument in a short speech in which he suggested that the medical aspects of the inquiry in British Columbia be studied. Although he had a cold, he made his point in guitar, mouth organ and his own song:

(Chorus) Don't you go digging for the dirty ur-an-ium,
It's no good for you and no good for me.
Stay away from the dirty ur-an-ium,
Open your eyes up and see.
What you gonna do with the dirty uranium?
Feed a power station, you want to fool around
with radiation?

Chorus

What they gonna pay ya for digging the ur-an-ium?
Enough for a new car, a computer or a C.B.
What price will you pay for digging the ur-an-ium?
Open your eyes up and see.

He asked who in Nova Scotia would take personal responsibility for the disposal of uranium tailings, and who would personally accept moral and financial responsibility for persons contaminated by mining activities.

160. CHARLES MUSIAL - REFERENCE

The President of the New Waterford Fish and Game Association and Chairman for Metro Alliance for Development (Environment Committee), offered material to the Inquiry dealing with the health effects of radiation exposure. In a short speech, CHARLES MUSIAL said *"Manufacture of plutonium 239 and its widespread use in nuclear power may represent man's most immoral act."*

MEETING NUMBER THIRTY - SEPTEMBER 7, 1982

RESTAURANT SHIP MARIAN ELIZABETH, MARGAREE HARBOUR

One of the most beautiful places in Nova Scotia is the coast of Cape Breton where the Margaree River enters the Gulf of Saint Lawrence. On one side of the harbour, near its mouth, is the ship and floating restaurant Marian Elizabeth. Running the restaurant are the May family, which had exchanged the insurance world of Connecticut for the challenges of a different way of life. Whether there is more, or less, stress in running a small business in Nova Scotia is for each to debate, but the May family was confident of its choice. R.J. McC.

161. ELIZABETH MAY - BRIEF

Recognizing that many of her points had been made by the Valley doctors, her one opposition was rooted in *"concern for human health and particularly for the gene pool on which our species survival depends."* ELIZABETH MAY also noted the other general issues being considered - environment, nuclear weapons, and the diversion of research and development funds from labour-intensive renewable energy forms to nuclear power, and the weighing of economic benefits. She quoted sources on the debate over nuclear versus coal power to conclude that nuclear power generation puts 35 to 81 times more naturally radioactive nuclides on the surface of the earth than does coal power. She thought this put concerns of the Voluntary Economic Planning brief into perspective. *"Clearly the major radiological mining hazard is uranium, since by definition it disturbs* *the largest quantity of radioactive material."*

She made the jurisdictional point, which she considered new to the Inquiry, that it is clearly a Federal matter. *"The only decision which is exclusively to be made by Nova Scotians is the decision of whether or not to allow mining. After that initial decision, in constitutional terms, it would be difficult for Nova Scotians or even our own provincial government to control the resources."* It would be nothing short of writing a blank check on the province's future.

She also commented on portions of the Kidd Creek brief and criticisms of environmentalists and ecologists by mining associations. Her counter thrust was that sincerity was being met by McCarthy-like smears.

Miss May welcomed the visit to several small Cape Breton communities by the Inquiry including Margaree Harbour. The brief contained an appendix containing several items on the issue of radiation, and an excerpt on Kidd Creek Mines Ltd. in the 1981 annual report of its owner, Canada Development Corporaton.

162. GEOFFREY MAY - STATEMENT

Speaking on the effects of nuclear technology upon him personally, 26 year old GEOFFREY MAY recalled going from a school room into a basement for an air raid drill while he was in elementary school. It was only later that he thought that this small trip was almost all the time one would have to seek shelter in a nuclear raid. His mother had also advised him not to eat snow because it contained strontium 90 from nuclear fallout from tests in Nevada. He would warn his friends not to eat snow, but they would and he would worry about their health. His mother would add a powder to his ice-cream which had something to do with fallout. During the Cuban Crisis the basement of their house contained canned foods and powdered milk.

He did not know the effect this had upon him psychologically, and *"I don't know if it took some of the joy out of my childhood, because I never lived in a nuclear free world, but I tend to think that it did."* A magazine article had suggested that the level of intelligence on this planet had dropped for people born after 1955. Was there a connection between increased radiation and the rise in crime, and disrespect for all private property and public institutions? Perhaps youth took drugs because the Earth could be destroyed at any time, and therefore a *"no future generation"* had been created.

He quoted Admiral Herman Rickover, the father of the United States nuclear navy, in his fears of radiation. *"Let us concentrate on chaining the monster we have created."*

163. REBECCA LYNNE MACDONALD - STATEMENT

The gathering on the restaurant ship could be likened to a family approach, as REBECCA LYNNE MACDONALD made a short speech of opposition. Within a few weeks of this meeting she was to wed the previous presenter.

164. JOHN MAY - STATEMENT

The Island of Cape Breton still has many natives who have the Gaelic. The only presentation to come to the Inquiry in the two languages of English and Gaelic was by JOHN MAY. This transplanted American also wore tartan as he made an attack on uranium mining in his adopted country. He used placards in Gaelic and his translations to argue that *"uranium should be left in the ground until the nuclear industry develops."*

165. STEPHANIE M. MAY - SONG

The difficulty of finding words to rhyme with "uranium" was solved by STEPHANIE M. MAY in a practical way - adding "ium" to many words which ended in "ain' or "ane". To the tune of the "Judge McCleave Waltz" recently composed, and accompanying herself on the piano, Mrs. May sang "Uranium!"

A sample verse was -

Pandora! So pandorable!
And though what she did was deplorable,
Her dreaded box didn't contain-ium
Evils as bad as uranium.

A footnote said the Three Mile Island nuclear plant came within 28 minutes of a melt down, which would have resulted in hundreds of thousands of deaths and the virtual end of the State of Pennsylvania.

MEETING NUMBER THIRTY-ONE - SEPTEMBER 8, 1982

BADDECK (COURTHOUSE)

166. MICHAEL CRIMP - LETTER

As president of the Trail Store and Cabins at Englishtown, MICHAEL CRIMP had not been able to properly present his concerns due to business commitments. He made two points: (1) that there should be *"no subsidies in any way ... even in the clean up stage"* of uranium mining; (2) should there be *"any question as to the safety or socio-economic repercussions"* a moratorium should be imposed on exploration or exploitation of uranium.

167. JEFFREY GOLD - STATEMENT

"One of the difficulties in the intelligent discussion of the hazards and benefits of uranium mining is that only a global and long range point of view can provide the proper perspective" according to JEFFREY GOLD of MIDDLE RIVER. He was speaking for BEVERLY BRETT who had originally asked to appear. The future should not be left to politicians or technocrats.

The statement said one version of the future would be a continuation of thought patterns characteristic of the Industrial Revolution. Some of these characteristics he considered to be a centralization of power, both political and material, the exploitation of non-renewable resources to fuel economic expansion, and the use of renewable resources in an inefficient and wasteful manner. Uranium mining is a child of our current form of industrialism and uranium mining is uneconomical and hazardous.

The alternative version of the future was based *"on the wise, safe and efficient use of natural resources, the replacement of capital intensive industries by labour-intensive ones, and the decentralization of power production."*

He was also concerned that nuclear power plants could produce the basic ingredients for atomic bombs. The Federal government's promotion of nuclear technology could only contribute to international tensions and an increased capacity for destruction - the opposite of the peace making attitude Canadians liked to think of themselves.

168. FRANK REID - STATEMENT

After compiling and discarding several briefs, FRANK REID wished to make one main point - resources such as coal and oil had been used *"not always to the best use and most certainly with no or very little thought as to the possible adverse effects."* So it is with uranium, with its tremendous energy potential. *"We have learned how to extract the energy from uranium ... (but) not as yet learned how to control, eliminate or dissipate its adverse effects from mining and energy extraction."* He called for the moratorium to continue until there could be control of adverse effects and potential hazards.

169. AARON L. SCHNEIDER - BRIEF

The familiar theme of the dangers from the release of radioactive materials into the environment by exploration and mining of uranium were dealt with by AARON L. SCHNEIDER. He spoke as a lay person with scientific training. Most of his references were to the Bates Royal

Commission in British Columbia.

The problems began with drilling, trenching and blasting which occur at the mine during advanced stages of exploration. There would be a permanent radon emission from open pit mines unless there was sealing. A Nova Scotian mine would likely be open pit *"especially where ore grades are low. No present mine designs adequately approach (the) concept (to seal tailings) as securely from the environment as was the original one."*

The brief included a list of failures at uranium tailings ponds, as noted by the United States Nuclear Regulatory Commission, and he concluded that such impoundments *"pose a serious and indefinite hazard to public health"* and Nova Scotians should not be asked to accept such risks when the jobs are few and the hazards endless.

170. SAMANTHA RESTINO - STATEMENT

As a 15 year old girl who had lived almost all her life in Nova Scotia, and wanted to live the rest of her life here, SAMANTHA RESTINO said she might not be able to *"if the land is contaminated by uranium. The choice of having a child, without the danger of a mutated baby, should be mine."*

MEETING NUMBER THIRTY-TWO - SEPTEMBER 8, 1982

ORANGEDALE, C.B. ELEMENTARY SCHOOL

177. LIZ CALDER - STATEMENT

As supervisor and interpretive guide at the Alexander Graham Bell museum, LIZ CALDER suggested that the philosophy which lay behind the inventions of Alexander Graham Bell, described as *"a humanist in development,"* should be applied. Alexander Graham Bell had done some medical experiments and discovered that radium could be used to cure cancer.

Before he died in 1922, Bell had decided that fossil fuels would "become extinct." For him the fuel of the future would be alcohol through the use of waste products. She told the Inquiry that Bell was concerned that he be remembered as a humanitarian concerned with all people's welfare. She said Alexander Graham Bell felt that *"we should be very careful about the beautiful life that we have in Nova Scotia and that nothing should be done to disturb this. ... Many of us are very concerned that that* (quality of life) *might be affected needlessly,"* she said.

178. BETSY JARDINE - STATEMENT

She noted that in Orangedale, income is very pluralistic, coming from many sources and the largest part of her family's farm income came from the sale of honey. She wondered if uranium could be carried by bees just as gold is carried by them. She stood firmly behind the position of the Nova Scotia Federation of Agriculture. *"Until more is learned about the means and ways in which uranium or radioactivity can* *get into our human food chain then there shouldn't be any mining or exploration in our province."*

179. **LYNN ZIMMERMAN - STATEMENT**

Her concern was with the policing of the uranium industry with respect to the disposal of waste material. *"It would seem only sensible to suspend uranium exploration until the disposal of tailings can be handled in a convincingly harmless way."*

180. **DOUG MacNICHOL - STATEMENT**

As an oyster cultivator for 12 years, DOUG MacNICHOL could advise that this was a creature that can concentrate almost any foreign material that is in the water and it is very well known that they can concentrate copper to an extensive degree and turn green as a result. He noted that they can be used as indicator organisms in certain areas to determine if there is some pollutant in the water. He stated that a lot of the birds at the mouth of the Columbia River were highly radioactive due to biological concentrations of radioactive material upwards in the food chain. In the oyster industry, *"all we really need is a suggestion that oysters have become radioactive and we're out of business."*

He said the uranium industry has tried to externalize its costs so that result of their operations are borne downstream by the taxpayer. They are also *"internalizing"* their costs by passing them on to future generations to worry about.

181. **DAVID QUIMBY - STATEMENT**

He had gone through issues of the magazine "Scientific American" in his concern with uranium problems and especially the control of tailings. DAVID QUIMBY was of the opinion that *"unless there is a definite need, a real critical need for power, I can't see that its worth the risk."*

182. JEANNE BERGERON - STATEMENT

She has spent five years in Cape Breton and had fallen in love with the land. Her husband had given up a $30,000 a year job as a lawyer in Montana.

They were looking for a better place to raise their children and so immigrated to Canada and Cape Breton.

"I have seen what mining can do. My husband worked at an open pit strip mine in Montana and it's very devastating even with the reclamation as to what it does to the land let alone the wildlife in the area."

183. BARRY BOWER - STATEMENT

He expressed a wide variety of concerns such as nuclear reactors not working, no method satisfactory to contain and dispose of tailings, and the use in nuclear weapons. BARRY BOWER condemned the Federal government for its sales abroad. *"We can keep uranium safely as possible in the ground."*

184. AL RODEE - STATEMENT

Using the song by Cat Stevens, "Father and Son", AL RODEE had the son saying that *"you can't prove that a mine is safe. Why should I take a chance?"* He presented pictures of PCB's in barrels abandoned on a road in Guysborough.

MEETING NUMBER THIRTY-THREE - SEPTEMBER 14, 1982

PUGWASH DISTRICT HIGH SCHOOL, PUGWASH

185. JANICE FIRSTBROOK - BRIEF

Problems associated with uranium mining and well water, based on personal experiences, were the theme of JANICE FIRSTBROOK of the Wentworth area. Her curiosity was touched off by the activities of Gulf Canada Limited, started in 1976 and continued for five years.

She had gone to the provincial Department of Mines and Energy, and examined the records of the company. The 1979 report spoke of the probability of economic mineralization in the Cobequid uplands. The technical reports were written by a geologist *"and almost impossible for the average person to understand."*

She felt that a separate department should monitor uranium exploration. The local health official should be advised in particular of radium tailings. *"When high levels of radioactivity are discovered, the area should be closely watched."*

A special problem was noted - if Gulf were building roads into exploration areas it would have to submit details for approval by the Department of the Environment, but if Scott Paper Company built roads in the same area to get at the forest it did not. Rock quarrying and gravel operations in the same area could also spread radioactive materials inadvertently. She recommended that the Department of the Environment should determine environmentally sensitive areas and notify government Departments.

She was concerned because the Gulf reports showed naturally high background radiation levels, and this could be increased by trenches or exploration openings, drill holes into aquifers and uranium deposits in bedrock, and the release of radon from exposed uranium-bearing rock.

Guidelines had not been brought in until 1979, or four years after exploration had begun. There were no penalties and no bonding. She considered that the Gulf company had violated the guidelines. *"An example is the core sample storage site located in Wentworth which was left easily accessible to the public, unlocked, unfenced, unmarked and unmonitored. These radioactive samples should have been turned over the Department"* and the Department was lax in ensuring that the company did so.

She turned to the problems of the high content of uranium in well water between New Glasgow and Cape Tormentine. In the paper for the Geologic Survey of Canada, quoted by Ms. Firstbrook, the uranium leached by the groundwaters could very well have come from the high relief and granite rocks of the Cobequid. She considered that disruptive exploration in the Cobequid could effect the water supply. But extensive baseline data were not taken before exploration so *"it is impossible to establish a causal relationship between exploration and high concentrations of uranium in well water and surface water."*

It cost $20 to test water for uranium and $40 for radium, prohibitively expensive for the average homeowner, and she thought that this service should be provided for free by government, and there should also be assistance to find and finance an alternative water supply.

Her recommendation also was that health studies should be carried out with reference to uranium ingestion before exploration were permitted, and in areas of high concentration of uranium it should not be permitted. She hoped the Inquiry would recommend a moratorium, and thanked the Nova Scotia government for establishing it. (The brief contained 22 references.)

186. DR. DAVID FORSHNER - STATEMENT

Because of the possibility that a uranium mine would be established in Wentworth, DR. DAVID FORSHNER as a general practitioner was concerned about the health of miners and the public.

The Wentworth area is highland, and is the watershed for the Pugwash, Wallace and River Philip rivers. *"Anything that might affect the rivers would almost certainly affect the people of this area along the Northumberland Strait."*

As a medical man, he recalled that it used to be common practise to irradiate certain troublesome skin diseases, *"but we are now reaping the whirlwind because these people are more prone to cancers of the head and neck."* Laboratory experiments showed that cells exposed to radiation would duplicate themselves in an erratic fashion, a form of cancer.

Dr. Forshner elaborated on his studies of statistics relating to miners and the general public. He concluded that there was increased danger. For the miners, *"the figure of two to three times incidence of lung cancer for miners seems well accepted. The moral question of whether this population should be sacrificed would have to be at least generally recognized if not answered before I would like to see such* *a mine established."* Carcinoma of the lung was a very unpleasant disease, without a cure, painful and debilitating and ending in death.

As for possible genetic damage, the information was inadequate for him to make up his mind. It would be foolish to make a decision to mine without this information. *"The same thing applies to the risk of increased radiation to the general public."*

He hoped that the moratorium would continue *"until the experience of others have been documented, analyzed and appropriate measures taken to eliminate the present risk"* including *"some dramatic change in mining or processing technology."*

187. CAROL FAULISE - BRIEF

Cumberland County has 450 farms covering 60,000 acres feeding more than 23,000 people, and many more smaller farms which sustain families, according to CAROL FAULISE, and agriculture was its third ranking industry. She was concerned about the effects of a short lived (up to 30 years) uranium mine upon an industry based on renewable resources. She believed 73 out of 83 wells tested in the North Shore showed abnormally high contamination due to uranium. *"Unfortunately government has not seen fit to establish base line studies to determine the extent, if any, that exploration has on our water supply."* She drew a connection between data kept confidential on exploration programs for two years and the possibility farmers would be supplying herds with radiative water and selling radioactive milk. She also said the public had not been protected from the core storage site in Wentworth.

Ms. Faulise went over the general concerns of physical disturbance of lands and waterways, contamination from mining/milling, and the materials both radioactive and others dumped into tailings ponds. *"Certainly there can be no iron clad guarantee of safety in anything, but there is not a safe system in operation at this time, nor does there seem the likelihood that one will be financially feasible considering the falling price of uranium today on the world market."* She read from the brief of the Nova Scotia Federation of Agriculture to the Inquiry, said uranium exploration was not of benefit because of the health hazard and not economically feasible because of the low quality ore, and supported the moratorium.

188. HARRIET FICE - BRIEF

A uranium tailings dump in one's neighbourhood would figure on anyone's list of the top ten of *"awesome assaults - physical, chemical and biological - let loose in our environment in the 20th century,"* according to HARRIET FICE. The Fice farm produces honey and has gardens and orchards, and is located about 10 miles from Pugwash.

Among her concerns: seepage can be controlled but not eliminated in the operation of tailings ponds; contamination by radionuclides from a tailings basin is inevitable; in 50 years the problems of emissions have yet to be solved; and a mining company or AECB could not be relied upon for dealing with the problem over the long term.

Nova Scotia was too small to give up an area of several hundred acres for a tailings pond. The 150 or so jobs for 10 years would not, with royalties, make up for the cancers and clean up of pollution.

Ms. Fice was a native of Nova Scotia who had also lived elsewhere before returning. *"I want to see it protected and most of all, treated rationally."* There was little market producing *"crumbs"* and the ore should be left undisturbed *"until we're sure we know what to do with it when it is disturbed."*

She closed with gratitude to be living in a country whose system of government, for all its weaknesses, allows a process like this to take place. "In most of the world, it's unheard of." There were 14 references, including three to "Environmental Geology of Uranium Exploration and Mining," Dalhousie University, by D. Meggison and G. Muecke, 1982.

189. CHARLES E. HAYNES - STATEMENT

"It might have been Canadian uranium that killed 125,000 Japanese in the war. We must not let Nova Scotia uranium meet a similar chore" said CHARLES E. HAYNES. He entitled his presentation: Does the responsibility end with the sale?

The actual death count from the atomic bombs dropped on Japan might not be apparent for years because cancer could take 12 to 40 years to show up. And the world continued to replenish man-made poison in the atmosphere, by bombs and by radioactive isotopes discharged by nuclear reactors and waste.

Plutonium would be made from any uranium mined in Nova Scotia and was incredibly dangerous. *"Because of plutonium, and the other fiendishly toxic by-products of fission, we must not choose to sell uranium. Every stop of the fuel process involves possible calamity."*

There were six references from Dr. Helen Caldicott's "What Can You Do" (Autumn Press, Brookline, Mass. 1978) and nine other references.

MEETING NUMBER THIRTY-FOUR - SEPTEMBER 17, 1982

WELDON BUILDING, DALHOUSIE UNIVERSITY, HALIFAX

190. DR. TERRY WHALEN - STATEMENT

A non medical Doctor, TERRY WHALEN spoke not for Ph.D's against uranium mining but as a family man, *"because what little I knew about uranium mining frightened me."* He had applied to speak at about the same time he had discovered that he was living in a home stuffed with ureaformaldehyde insulation.

It was difficult to get animated by technical terms, but not so when the Medical Society of Nova Scotia spoke against obvious health dangers. The gamble was not worth the *"marginal benefits"* and he hoped that we would not allow Nova Scotia to be a new target for exploration because we were *"poorer, somewhat backward, sort of lower-dog place and population ... more easily manipulated."*

In his examination of the literature, he could not see conspiratorial links between multinational mining companies and the nuclear arms industry, *"although that might be the case,"* or any connection between those who speak against uranium mining and *"Moscow, the KGB, Pinkos (so called) or just straightforward subversives."* But the suspicion and paranoia brought about by the debate was spiritually fatiguing and doing damage by the animosities it aroused. There were many like himself who would say that *"the mining of uranium in Nova Scotia looks like a very dangerous and absurd thing."*

191. RONALD H. LOUCKS - DECISION TREE

As a consultant on oceanography, RONALD H. LOUCKS used the approach of the Bayesian Decision Theory on the uranium issue, and reached the conclusion *"that we are best advised to postpone uranium mining in Nova Scotia for some time to come."*

He described the decision tree for the uranium issue, string information from it like ornaments at Christmas, and discussed the strategies to decide which branch would be the best one to choose. As noted, that branch was postponement of mining.

In its simplest form, there were two branches or possible actions, to postpone or to mine. Each broke down into two branches - to postpone into "worse than predicted" and "much as predicted" and to mine broke down into the same. These were possible outcomes or states of nature.

One proceeded on the premise that when a new piece is added to the economy *"this new piece should not cause a whole series of new problems beyond the perview of the expective involved. Neither should this new piece worsen the problem it intended to solve."*

A uranium mine to create employment should not, for example, take away jobs in tourism.

He then looked at five different trees - economic, environmental, health, moral and "a holistic value I call the Nova Scotia pattern." That is, he digested the views obtained from the presentations made to the Inquiry.

The final shope of his decision tree was:

Postpone - worse than predicted - one large benefit;
much as predicted - one large benefit and one small burden;

Mine - worse than predicted - one small benefit and
four large burdens;
much as predicted - one small benefit and two
large burdens.

"In the environmental risk situation, the false position (deciding the catastrophic hypothesis is true when it is not) carries a lower cost than the false negative (deciding that uranium mining is benign when it is not). So there is no paradox. Society chooses to avoid the higher costs in both spheres."

Five references.

192. DONALD F. CHARD - BRIEF

Because of the risks and the uses for most of it, uranium mining in Nova Scotia was considered to be inappropriate by DONALD F. CHARD. He felt compelled to appear because one of his friends, a college classmate, died from cancer which developed as a result of research with nuclear materials, and another friend developed a lung condition which nearly killed him while working in a New Jersey chemical plant which produced lead compounds for paints.

In the past, industry had a poor record in dealing with radioactive materials, and in instances such as the fluorspar mine at St. Lawrence, Newfoundland, was slow to implement protective measures. In Nova Scotia, workers using chain saws sometimes develop circulatory disorders - a seemingly innocuous activity with serious long range implications.

Better standards had reduced the health risks for uranium miners, but risks remained particularly for miners who smoked. As for the argument about the hazards from coal-fuelled electricity being greater than the short-term health hazards of nuclear energy production, he considered that the technology exists to reduce sharply the risks in the coal industry. The same could not be said of the latter. *"In effect, in the case of coal, the generation which uses it will pay the cost. In the case of nuclear energy, future generations will pay the price."*

He referred to the debate over standards as to permissible exposure to radiation, to the use of almost all uranium mined in nuclear weapons *("morally abhorrent")* or nuclear power (doubt as to safe disposal of wastes and the dangers in operation including the new one of thermal shock in which the steel vessel that houses the radioactive core becomes brittle from radiation.)

He concluded that the government should *"ban uranium mining as long as there are serious risks associated with it, and as long as the uranium mined here would be going to nuclear power plants and for nuclear weapons."*

Eleven references.

193. NOVA SCOTIA VOICE OF WOMEN - BRIEF

It is insupportable for proponents of uranium mining and nuclear power to argue that we can enjoy "peaceful" nuclear power without increasing the threat of further developments of nuclear weapons. This was the gist of the presentation by ELIZABETH MULLALY for the NOVA SCOTIA VOICE OF WOMEN.

The countries which purchase 45 % of Canadian uranium are Britain, France and the United States, all having nuclear weapons programs. One could not deny the link between civilian nuclear power and nuclear weapons. India was an example - Canadian uranium and Canada's help in building a reactor led to the nuclear bomb there. *"Nuclear power plants provide both the technological know how as well as the raw material (reactor grade plutonium) for nuclear weapons."*

The brief did not propose to deal with environmental and health hazards, but the same problems created by nuclear bombs are inherent in the civilian nuclear industry.

It explored protection or lack of it, from the Non-Proliferation Treaty and the International Agency on Atomic Energy. France had not signed the treaty yet Canadian sales continued, and a French consortium owned 80% of the mine at Cluff Lake. We talk to other non-signatories such as Argentina, Pakistan and Brazil. *"It is fatuous for Canada to present an image of having a responsible attitude towards nuclear weapons proliferation."*

The public would look to government for information in making rational decisions. V.O.W. rejected the thought that government would have a right to maintain secrecy for security reasons.

This argument was fallacious for two reasons. It presupposed that security could be provided against the atomic bomb when in fact no security could be provided and it gave support to the view that citizens had no contribution to make, but the underlying reason was that government feared that knowledgeable citizens might interfere with government policies and processes. The brief considered that government suppressed civil rights by surveillance of dissident groups. Voice of Women called for a continuation of the moratorium.

194. RECREATION ASSOCIATION OF NOVA SCOTIA - BRIEF

There was increasing importance of recreation as a legitimate planning concern and the RECREATION ASSOCIATION OF NOVA SCOTIA felt there was a need to make a special study of outdoor recreation because of uranium exploration and mining. The members had unanimously supported a moratorium at its annual meeting in November, 1981. The spokesman was GLENN BISSEX. He described the Association as having a diverse membership, professionals and others, whose primary purposes were to promote, stimulate and advance public parks and other recreation facilities, recreation and leisure services in the province. Presently with support from the Nova Scotia government it was offering a series of work shops to improve the effectiveness of volunteers.

The 1981 resolution called for the moratorium to continue until benefits can clearly be shown to outweigh risks. The impact on recreation should be part of the assessment. The brief set out ideas as to how this could be done:

i) by reviewing the literature and from it establish a tentative list of objectives for protecting traditional and potential recreation opportunities.

ii) by assessing the prevailing conditions in Nova Scotia by measuring environmental quality, present recreation behaviour and potential recreation behaviour.

iii) by considering prevailing (pre-development) conditions in Nova Scotia, establish objectives for protecting traditional and potential recreation opportunities.

iv) further, by use of appropriate models make predictions of impact on recreation by uranium exploration and mining using best possible, worst possible and most likely impact scenarios. Further by comparing with the established objectives determine areas of predicted non-compliance.

v) by examining how non-compliance affects potential and traditional recreation opportunity assess potential recreation costs and benefits.

vi) and finally by assessing recreational impact along other areas of concern and interest make decisions for further action.

The brief dealt with studies in a variety of ways, including seven questions involving a lake near a potential uranium mining operation. It concluded that a five year study costing at least $1,000,000 would do the job adequately, and this money should be raised from the uranium industry.

There were eight references, most of them relating to studies of the Shubenacadie, Stewiacke River Basin, and twelve pages of a "*preliminary proposal for assessing impact on recreation.*"

195. IAN BALL - BRIEF

Most of his roots are Nova Scotian, but in the mid-seventies IAN BAll was Director of Energy Research for the National Film Board in its Environment studies in Montreal. As such, he had studied the gamut of energy options, talked with top ranking scientists and energy specialists, directed detailed research by others, and had developed a number of concerns. He concluded that no steps should be taken *"to expand the activities of the nuclear industry in Nova Scotia until there has been a long period of the widest possible public discussion,"* using government funding.

The concerns that led him to this conclusion as *"seen from the tranquillity of the South Shore,"* included (numbering by the Inquiry):

1) There should be conditions of absolute stability and predictability if we are to develop commercial nuclear power at home and abroad. Man is neither stable nor predictable.
2) Six environmental concerns starting with radon gas and ending with the costs of monitoring waste storage sites.
3) Two concerns relating to atomic weaponry and the destabilization of the world community.
4) Centralization of political and industrial power in Canada and the reduction of self-reliance in Nova Scotia.
5) The possibility of blackmail by nuclear accident - military or civil.
6) Muzzling of critics by *"unsavoury means"* in Canada and elsewhere.
7) *"Technological colonialism"* or the persuasion of Third World countries to use their scarce capital on unsuitable

> things. Failure at the political level to examine all energy options, failure to bring various options before the *"public in widely stimulated public discussions,"* and failure to regulate the Canadian industry with sufficient vigour.

He tended an acre and a half at Aspotogan and grew vegetables but he did not need a tractor, even if one was offered at bargain basement prices. If one was offered at nothing down and forever to pay, he would consider buying it and renting it out. But he might not be able to do so considering that you can't plough rock on the Aspotogan Peninsula. Therefore he would be stuck with an obligation and a technology he didn't need. He likened this to the entry of the nuclear industry in the Maritimes.

On burden of proof, *"let them show absolutely that we will not get more cancer than the rest of the population"* by uranium mining.

If more reactors were built, there would be a demand eventually for uranium from Nova Scotia and if mined it would be gone in a few years. *"By then we will all live in a world dependent on plutonium and the breeder reactor ... a pretty grim prospect."*

This would probably lead to a Garrison State, one armed to the teeth with police to protect the power system from attack. Reactors would be built in clusters near cities, because they would be easier to guard, and the population would gravitate there.

The alternative would be to wind down the nuclear industry, and, in Nova Scotia, use coal and the technology of fluidized bed combustion.

This has the virtue that there is virtually no pollution. Coal could be converted to gasoline, or forest products wastes.

He drew the picture of a thief with *"half an ounce of plutonium and a cheap device you can buy at Canadian Tire"* who *"could make Toronto or Vancouver or Halifax uninhabitable for centuries."* If you had such a person in your clutches and only half an hour to get his device off, *"how much priority would you give to this person's civil rights?"*

He mentioned incidents including his own experience which led him to believe that the nuclear lobby was trying to censor critics. His film "No Act of God" had been criticized by the Canadian Nuclear Association but was allowed to remain in circulation after investigation.

His final point was that one must give way to experts when they judge technical matters but not on elements in the nuclear power debate which are not technical, that is, are trans-scientific.

(Twelve references)

MEETING NUMBER THIRTY-FIVE - SEPTEMBER 21, 1982

WELDON BUILDING, DALHOUSIE UNIVERSITY, HALIFAX

196. PATRICIA KIPPING - FILM

Describing herself as the founder and organizer of the Safe Energy Film and Video Festival, an archivist and a mother, PATRICIA KIPPING felt that the future was severely threatened by nuclear weapons. *"Nova Scotia must do her share in suffocating the nuclear arms race and leave the uranium in the ground."* She presented "If You Love This Planet" by the National Film Board.

197. PROFESSOR DOUGLAS MEGGISON - BOOK

The book, "The Environmental Geology of Uranium Exploration and Mining", was presented to the Inquiry by its co-author, DOUGLAS MEGGISON. His presentation was divided into two parts: a "political statement" and an environmental argument against uranium mining. As to the former he stated that, *"The preponderance of anti-uranium mining opinion tells me ... that the vast majority of informed public opinion is against uranium mining in this province."*

As for his environmental argument, he said that various uranium mining companies will disturb the existing ecosystem by digging a "big hole in the ground." He remarked that there were only two major things that will keep the radioactive waste from contaminating a potentially huge area. Both of these will be man-made: a tailings dam and some sort of tailing's pond bottom barrier. We would be depending on them to maintain a "normal living sub-ecosystem in homeostasis or stable balance." He was dubious that the corporate monitoring required for this could continue for the more than 300 years necessary when the oldest corporation in existence is the Hudson's Bay Company of Canada "only 380 some odd years old." He concluded by saying that *"ecologically speaking, relying on only two main bulwarks against disaster is simply absurd."*

198. CANADIAN NATURE FEDERATION - BRIEF

The views of the CANADIAN NATURE FEDERATION, which includes about 100 affiliated environmental organizations and 500 Nova Scotians and 19,000 Canadian members, were given by HAL MILLS, vice-president for the Atlantic region. The principal recommendation was that the uranium industry make a detailed presentation at phase 2 *"spelling out its plans for long term tailings management"* and if this could not be done in an environmentally acceptable manner *"the Inquiry should be adjourned until it can do so."* Independent experts should be engaged and intervenor funding made available.

The Association publishes NATURE CANADA, operates a bookshop service, and uses environmental education to conserve nature and natural resources. It operates an Environmental Action Program. A seven page appendix, attached to the brief, contained its policies and principles to guide it on environmental issues.

The Federation did not regard itself as anti-uranium, and had never taken a position in the past. Proposed developments should not be approved *"where there are significant environmental impacts which cannot be mitigated."* It did want to establish the truth about uranium mining environmental issues through the Inquiry. It considered that the Inquiry should have its own independent experts as witnesses or advisors.

The brief concentrated its concern on the issue of the long-term management of tailings, not only from uranium mines, but from others such as lead, zinc and coal, which produce radioactive tailings.

Over the short-term it might be possible to keep the impacts at acceptable levels, but permanent disposal technology apparently does not exist over the long-term. Environment Canada had pointed out to the Inquiry that standards did not exist for protection of the ecosystem from the effects of radiation. *"Specific research is required to determine the environmental impact of radiation on plant communities and ecosystems."* Also, little was known, according to Environment Canada, about the somatic or genetic effects of specific radionuclides on wildlife.

Reference was made to the appraisal of management of uranium mines tailings carried out by an advisory panel to the Atomic Energy Control Board in 1978. The Federation considered that the most relevant considerations were: the recommendations against settling radium precipitates in lakes and swamps; unrealistic dependence on human intervention in any method of waste management; the need to find answers for long range management methods as soon as possible; transfer of abandoned tailings sites to a responsible authority (conclusions 6, 9, 10, 11 and 13).

The industry argued that it should be allowed to go ahead while solutions were sought, on the assumption that such would be found. The Federation likened this to giving a person the degree of Doctor of

Philosophy before it was earned.

Experts agreed that the required system must be a walk-away one but *"the Nature Federation knows of no existing technology capable of developing such a system."* (Seven footnotes, four of them concerning Environment Canada's presentation to this Inquiry, and a seven page single spaced statement of purposes and principles.)

MEETING NUMBER THIRTY-SIX - SEPTEMBER 22, 1982

BURKE EDUCATION CENTRE, ST. MARY'S UNIVERSITY, HALIFAX

199. ALEXA McDONOUGH - BRIEF

Uranium mining should not be allowed to proceed in Nova Scotia and the opposition of the vast majority who have appeared before the Inquiry should be heard by the Provincial government, according to ALEXA McDONOUGH, M.L.A. Her presentation was made on behalf of the New Democratic Party of Nova Scotia. It concentrated on regulation, economics and use in nuclear weapons.

Regulation - Licensing was required by the Atomic Energy Control Board *"only at the stage of removal of more than ten kilograms of uranium. Approximately 10,000 kilograms of ore would have to be mined to produce 10 kilograms of uranium."* In effect A.E.C.B. has no regulations governing exploration for uranium in Nova Scotia. Exploration had begun in 1975, hundreds of licenses had been issued, but drafting of guidelines did not begin until 1979.

Lack of strength in the guidelines and the poor legislative record of the province on worker health and safety were charged. (Mrs. McDonough made several references to the larger study on regulations made by an earlier presenter, Marilyn Manzer). She concluded this portion by asserting that *"workers have learned painfully and only too late that the resources of mining companies and the government were not to be trusted. They learned the truth only after irreparable damage had been done to human life."*

She was not assured by a statement attributed to Dr. Don Pollock of Kidd Creek Mines that tailings would be disposed of so thoroughly you could picnic on the waste site.

Economics - Mrs. McDonough said that the nuclear industry in Canada was in serious trouble for two reasons - its price was dropping because of decreased demand and over-supply, and the demand for nuclear power facilities was also declining. She noted the heavy involvement of the Federal government in promoting the nuclear industry, including its losses on sales abroad and its writing off loans to heavy water plants at home.

Three critical questions should be asked of support for this "floundering giant":

1) financial soundness of the deals (nuclear power plants in Canada, sales of CANDU reactors abroad);
2) the morality of the situation; and
3) the effect on world tensions and prospects for peace.

Canadians had everything to lose and nothing to gain by selling nuclear power to the American markets.

Her brief set out direct help which could be given by the Provincial Government, (Development grants or low interest loans from the Department of Development, by Industrial Estates Ltd. or directly from cabinet by Order-In-Council, special assistance by the newly created Nova Scotia Resources Ltd.; access roads funded by the Department of Transportation and Development) and by the Federal government (subsidies of wages under Manpower Training Programs and employment tax credits) and by both a flexible royalty system and no corporate income tax until the operation turned a profit. Indirect costs to

Nova Scotia would be the disposal of tailings and the disruption of local communities by the temporary additions of people for the 10 or so years of life of a mine. Again she quoted Marilyn Manzer's presentation.

Uranium mining was capital intensive in nature. If Australian experience were true in Canada, two jobs would be created for every million dollars invested. In Canada, Statistics Canada showed these returns (between 1966-1975) - 314 agriculture and fishing, 320 forestry, 750 in construction, 1592 in trade, 62 in mines, quarries and oil wells. *"The lifeblood and the backbone of Nova Scotia's economy are primary resource production and small business."* The province needed labour-intensive jobs. Uranium mining was incompatible with agriculture and tourism.

End Use - There was a relation between nuclear generation of electricity and the production of nuclear weapons, and plutonium was inevitably a by-product of nuclear fission. Canada used only a small part of its uranium production, and 85-90% went abroad. *"There was an insane proliferation of nuclear weapons"* and the nuclear power industry was, unintentionally, contributing to the risk of nuclear war as was concluded by the Ranger Inquiry in Australia and was true in Canada.

There was a bibliography and an appendix, "Cost Disadvantages of Expanding the Nuclear Power Industry" by Dr. Gordon Edwards in the Spring, 1982, "Canadian Business Review."

200. **MARGARET CONRAD - BRIEF**

Her own heritage might be to face a moose on the South Mountain of the Annapolis Valley, but MARGARET SLAUNWHITE CONRAD preferred to *"keep company with a moose than a uranium mine."* This very conclusion came from a member of the Department of History of Acadia University.

She had grown up in Falkland Ridge, near Springfield, and would be heir as an only child to the 100 acres lived on by her father and mother. *"I do not want my inheritance to be appropriated, or worse, polluted by an industry which, by all accounts, has little concern for people and even less for posterity."*

Her concern began when the Provincial government began to offer attractive prices for land, and a friend in government told her that the government wanted to control large sections of the South Mountain so it could lease rights to companies. Dr. Conrad had *"fleeting dreams of becoming a uranium princess."*

She studied information at Acadia University about uranium. She found that its market was not in a healthy state. She did not consider that Kidd Creek Mines would want to open a mine for altruistic purposes, and it was more likely they wanted *"at the expense of the Nova Scotia taxpayer to keep their mining teams together, giving them a chance to tread water profitably until such time as operations pick up elsewhere."* Her preference was for careful management of renewable resources rather than one-shot solutions which would not bring vast wealth or hundreds of jobs. She thanked the government for setting up the Inquiry because it forced her to do research. As for the moose, her father had forecast that there was so much out-migration that she would go back in 25 years to see only that animal.

MEETING NUMBER THIRTY-SEVEN - SEPTEMBER 28, 1982

BLOOMFIELD CENTER, ST. FRANCIS XAVIER UNIVERSITY, ANTIGONISH

201. DR. A.R. ROBERTSON - REPORT

A report on the views of the staff of St. Martha's Hospital in Antigonish was given by Dr. A.R. ROBERTSON. Notice had been given of the resolution passed by the Council of the Medical Society of Nova Scotia and, on September 23rd, the motion was unanimously approved by the staff. Dr. Robertson had moved the acceptance. The order of the meeting was drawn up by the Antigonish Environmental Coalition and AVON BURKHOLDER introduced the speakers. Dr. Robertson had three main reasons for his opposition to uranium exploration and mining. They were based on the reports of the Medical Association of B.C. and the Bates Commission and of the Medical Society of Nova Scotia to this Inquiry. Firstly, *"with present technology it is impossible to prevent an increase in radiation related disease, most significantly carcinoma of the lung, osteosarcoma, leukemia, and malignant lymphoma."* As an example he said that adequate studies did not exist to take into account the latency period for development of osteosarcoma, which is estimated at 12-50 years following exposure. There would be deterioration in health within 50 miles of a mine.

Secondly, he considered that exploration in Nova Scotia took place under guidelines which were not enforceable and not under regulations. The B.C. Medical Society had concluded, and he agreed, that there was a delay in recognition of hazard and protection of the worker in Canadian regulatory and uranium industry history.

Thirdly, use in nuclear weaponry and bearing the cost, the beneficiaries of any uranium exploration and mining would be companies engaged in the business, but *"we, as a province, do not need this one to support ourselves".* Many would object to weapons or risks from power plants, and all would have *"to support a massive increase in our already overburdened health facilities to* accommodate *the casualties of uranium mining."*

202. DR. ROBERT SERS - STATEMENT

As a concerned citizen, family doctor and parent, DR. ROBERT SERS was opposed to uranium mining, especially in populous areas. *"If it is not safe to mine it, why explore for it?"* Exploration drilling could have disastrous effects.

In a generally stated argument he noted radiation and the potential danger of reactors. *"In addition to this, the process will in all probability be rendered obsolete by the advent of fusion power which is clean and appears to be coming in the next 20 years or so."*

He referred to several of the points presented by the British Columbia Medical Association. He quoted the resolution, passed without dissent at the 128th annual meeting and 17th meeting of the Council of the Medical Society of Nova Scotia.

He disagreed with the Council's position that uranium exploration could be allowed to resume under rigidly regulated safeguards, with the simple statement - *"If it is not safe to mine it why explore for it."*

203. STEVEN LEE - STATEMENT

A variety of quotations from various sources was offered by STEVEN LEE, relative to experiences in British Columbia and Ontario. No new points were raised in the hand written notes he presented, but he did have a personal experience which he related.

For several years he had come down Salmon River in Cape Breton by canoe. At Loch Lomond, Yava Mines had opened an open pit lead operation, and its operations had led to contamination of the water and there was a large cost of cleanup. *"This was a lead mine - can you imagine if it had been uranium."*

204. CHRISTOPHER M. GRIFFITHS - STATEMENT

Having come from Southern Ontario 10 years before to escape *"the dehumanizing effects of a polluted, industrial environment"*, CHRISTOPHER M. GRIFFITHS had found a good place to live and raise a family at West Lakevale in Antigonish County. But everything was not fine. He thought the government had the attitude *"that big is beautiful and that the most important thing we can possess in this life is the almighty dollar."*

There was the threat of cancer, and the fact that parts of the province were dangerously radioactive through natural deposits. He was surprised there should be exploration and consideration of mining. He called for a comprehensive, long-term wood management plan. Uranium mining should be carried out in places that may already be beyond hope.

205. CAROL ENGRAM - STATEMENT

Concern that uranium exploration could damage the James River which supplies the Town of Antigonish was expressed by CAROL ENGRAM. She was also concerned with levels of radioactivity in food or tourist areas which could drive away purchasers or visitors. She considered that in the sale of reactor produced plutonium *"we are given 50% chance of war."* These concerns were real to her as a mother, woman and fellow citizen of planet Earth.

MEETING NUMBER THIRTY-EIGHT - SEPTEMBER 29, 1982

WELDON BUILDING, DALHOUSIE UNIVERSITY, HALIFAX

206. TONY SEED - STATEMENT

The Marxist-Leninist position on opposition to uranium mining was given by TONY SEED who has been a Federal candidate on several occasions. He described himself as a journalist with the Globe and Mail of Toronto who was fired because of his political beliefs. The rambling and disjointed speech of 94 minutes (when 30 had been promised) included attacks on several Nova Scotians, other Canadians and Americans, and suggested that Albania be the model for ecology. Several promises to the Inquiry, including one to deliver the typewritten brief which he read from were not kept, and his typewritten but unsigned letters revealed no address.

MEETING NUMBER THIRTY-NINE - OCTOBER 1, 1982

BURKE EDUCATION CENTER, ST. MARY'S UNIVERISTY, HALIFAX

The Canadian Nuclear Association made four separate presentations at this meeting. For handier reference, they are dealt with separately.

207. CANADIAN NUCLEAR ASSOCIATION - STATEMENT

DR. JOHN FOSTER

The former President of Atomic Energy of Canada Limited, DR. JOHN FOSTER, supplemented his extemporaneous statement with the use of slides. Most of his career has been associated with the construction of thermal and nuclear power plants, since this Haligonian graduated from the Nova Scotia Technical College.

Six and one-half billion kilowatt hours of electricity were used in Nova Scotia in 1981, of whicn 5.5 billions were produced from thermal sources and the remainder as hydro-electricity. The coal resources of the province would probably produce 40 years of electric energy. The options to replace the coal would be tidal and uranium.

Slides were shown of nuclear power plants including that at Point Lepreau, New Brunswick. Seven of the top 10 efficient nuclear plants in the world were Canadian.

Dr. Foster then dealt with four concerns:

1) That any operator should be able to live up to its commitments, and the mine should *"not be a marginal development likely to fail for economic reasons."* The mining company should be able to protect the health and safety of the miners and of the public;

2) In close to 100 reactor operating years, in Canada, no one had been over-radiated beyond the required level, the plants tended to be safe place, and the Ontario record was better with its nuclear plants than with its other plants;
3) There must be good regulations. There is no reason why one can't operate mines for safety;
4) There was concern about the use for other (weapon) purposes.

CANADIAN NUCLEAR ASSOCIATION - BRIEF

208. DR. DAVID K. MYERS

The health effects of radiation and the basis of exposure limits were dealt with by DAVID K. MYERS, a doctor of philosophy in pharmacology who is head of the Radiation Biology Branch of the Chalk River Nuclear Laboratories. His areas of expertise are in the environmental and occupational hazards of low level of radiation, and the health effects of energy production. He has published his studies consistently since 1949, and there were 154 references, mostly in associations with others, as to his work. This presentation acknowledged the valuable comments of G.C. Hanna, J.R. Johnston, Dr. A.M. Marko and R.V. Osborne. Exposure to low doses of ionizing radiation from natural sources are a fact of human life, from cosmic, soil and rock, and body sources. About the same amount comes from radon in buildings, and from medical diagnoses, and perhaps one tenth of the same amount from all other sources combined (weapons fallout, air travel, nuclear power, fossil fuels, television, luminous dials, etc.) The average annual radiation dose in North America was about three rem per year. (Rem is defined as the absorbed dose of any ionizing radiation which has the same biological effectiveness as one R A D of X-radiation. *"Medical x-rays are the standard with which all other types of radiation are compared."*

Some of Dr. Myer's presentation concerned the earlier submission by the Valley Medical Association. One suggestion there was that upper and lower limits to the uncertainties in risk estimates might be in error by as much as 100-fold *"and that 40 to 50% of human cancer may result from background radiation."* This was rejected after review in the 1980 report of the Advisory Committee on the Biloigical Effects of Ionizing Radiations to the National Academy of sciences, Washington (B.E.I.R.) *"... if this suggestion were true, then the use of X-rays and radio pharmaceuticals for diagnoses by physicians would also be responsible for some 40 to 50% of all cancer. There is no evidence to support this hypothesis and a value of 0.5% of all fatal cancers caused by medical x-rays seems more reasonable"* (or one in every 1,000 deaths in Canada).

Dr. Myers noted the variety of bodies dealing with radiation hazards - B.E.I.R. (referred to in the previous paragraph), the United Nations Scientific Committee on the Effects of Atomic Radiation (U.N.S.C.E.A.R.), the International Commission on Radiation Protection (I.C.R.P.), and the U.S. National Council on Radiation Protection and Measurements (N.C.R.P.). There was little overlap in their recent studies. These groups would consider the same primary data, and there was no major discrepancy in the estimates of the biological hazards that were derived. *"At low doses, the potential late effects of concern are (a) induction of genetic changes in the progeny of exposed persons,* *and (b) induction of leukemia and other types of cancer in exposed persons."* Sister Rosalie Bertell maintained that low doses of radiation caused non-specific aging effects proportional to radiation dose, but this assumption was not supported by the large amount of evidence available.

B.E.I.R. and U.N.S.C.E.A.R. had found *"that any shortening of the life-span at low radiation doses is due solely to induction of cancer with no other non-specific aging effects."* His presentation therefore would concentrate on genetic effects and cancer induction.

Genetic effects were dealt with at pages 6-9 of his brief. *"The genetic effects of radiation are not unpredictable and there is a great deal of reliable evidence available from which these effects can be predicted within reasonable limits."* The major problem was that radiation effects were too small to be directly measureable in human population. There was 10,000 times more risk than a stillbirth and/or major congenital defect and/or death during the first post natal week would occur from the marriage of first cousins or from twin births than by exposure of the parents to one rem of radiation. Uranium miners were normally exposed to radiation doses in the region of 0.5-2 rem per year, or during the usual reproductive period of a man, 18-30 years, from 6-24 rem.

Induction of cancer occupied pages 9-15. As in the preceeding section, when the experiences of parents from the Hiroshima and Nagasaki bombings had been studied (*"no statistically significant change in any of a variety of genetic end points"*), he looked at the causes of death of the survivors and found that less than 5% could be attributed to radiation induced cancer.

He referred to the people who were extensively studied as to radiation-induced cancer, such as the Hiroshima and Nagasaki survivors, radiologists, uranium miners, patients undergoing medical exposure, and those living in areas of high natural background exposures. *"There is predicted to be 2-3% chance of developing a cancer as a direct result of whole body exposure to an accumulated dose of 100 rem ... as the dose is reduced, the risk is reduced proportionately."*

Inhaled radon daughters and ingestion of radium by uranium miners were considered. The epidemiological approach had uncertainties because not enough was known about data for the past, and more especially when radon daughter concentrations were very high and uncontrolled and when most of the past exposures occurred. The dosimetric approach was adopted by the I.C.R.P., which in 1981 *"recommended* 1.65×10^{-4} *lung cancer per WLM as the best single value for estimating the hazards of inhalation of radon daughters averaged over a working lifetime."* The risk of deleterious effects from inhalation of thorium daughters would be about three times smaller.

He concluded this section with observations about radium 226 in most drinking water. *"The concentration of radium in drinking water in most Canadian cities and towns do not normally exceed 0.3 picocuries per litre. (A picocurie corresponds to 2.2 radioactive disintegrations per minute; the adult human body normally contains more than 100,000 picocuries of radioactive materials, mainly potassium-40, from natural sources. We normally ingest on the average about 1-2 picocuries radium-226 per day from natural sources and inhale 20,000-40,000* *picocuries of radon plus radon daughters per day, again from natural sources.) Concentrations of 5-10 picocuries radium per litre are however not uncommon in well and mineral waters in certain areas of the world including parts of North America. This radium comes from natural sources and is not due to uranium mining."*

No excess bone cancers have been observed in persons with less than about one microcurie radium-226 in their bone and the dose response curve does not appear to be linear.

Dr. Myers then turned to regulatory limits. The legal Canadian limit for maximum permissible dose of whole body radiation to radiation workers was set at 15 rem per year initially and reduced to 5 in 1960, and was based on I.C.R.P. recommendations. All Canadian nuclear establishments are operated under these rules. The maximum permissible exposure to radon and radon daughters was set initially at 12 WLM per year and reduced to 4 WLM per year in 1959. When uranium miners in Canada, Czechoslovakia and the U.S.A. were receiving potential exposures of 100-300 WLM per year in the 1940's, an appreciable number died from lung cancer. In Ontario uranium mines, exposures were up to 96 WLM per year in the early 1950's but reduced substantially when Canadian standards based on I.C.R.P. recommendations were imposed. In 1979 the average exposure was 0.7 WLM per year.

Reference was made to the exposure experience of Saskatchewan uranium miners, over 94% having less than half the permitted maximum, and the experience there in solving human problems associated with the regulation of occupational health and safety. The federal and provincial aspects of jurisdictional problems were noted.

ALARA was then considered, and produced some especially strong criticism of the brief of the Valley Medical Association. ALARA as defined by I.C.R.P. was *"all exposures should be kept as low as reasonably achievable, economic and social factors being taken into account."* This actually formed part of a formula whose other two components were: no practice shall be adopted unless its introduction produces a positive net benefit, and the dose equivalent to individuals shall not exceed the limits. *"It is interesting to find certain representatives of the medical profession (Young 1980, Phillips 1982), which would seem even in the recent past to have been rather lax about applying the same principle to the use of medical X-rays for diagnostic purposes in Canada (Taylor 1979), objecting to the ALARA concept. The two documents noted above (Young 1980, Phillips 1982) have, to the best of my knowledge, not been approved either by the membership or by the executive boards of the respective provincial medical associations and would seem to be in direct conflict with the most recent approved statement from the American Medical Association. This latter concludes that "the philosophy of maintaining exposures of workers at levels as low as reasonably achievable (ALARA) is commended" (AMA 1981). The copy of the Phillips 1981 document provided to me suggests that the latest recommendations of the I.C.R.P. have "dispensed with a permissible dose and suggested instead the ALARA concept (as low as reasonably attainable, social and economic factors taken into account). Thus the scientific basis for determining allowable exposure to nuclear workers has been dismissed and replaced with a political-social* *arbiter." This particular statement from Phillips 1981 as quoted above is false and unworthy of anyone who claims to accept the ethical position of the Canadian Medical Association as cited in Phillips 1982. The same description applied to other portions of the copy of the Phillips 1982 document that was provided to me. If the authors of this Phillips 1982 document disagree with this assessment and believe that they have something new to contribute to our knowledge, it would seem only reasonable to a scientist to ask them to submit this document to an internationally-recognized scientific journal so that their concepts could be considered by and would be of value to people throughout the world."*

The final portion of the brief dealt with the predicted health effects of low levels of radiation. A safe industry might be defined as one with an upper limit of one fatality per ten thousand workers per year. About 80% of Canadian workers are employed in safe industry. *"At the suggested limit for a safe industry, about one worker in 200 would suffer an occupational fatality if they were employed for 47 years from age 18 to age 65. The risk of death from other, non occupational causes (in the same age span) would be about 40 times greater."*

Any human activity has a certain health hazard. By comparison - lumbering, mining and fishing have ten times the occupational death rate of that in all manufacturing industries; agriculture and construction higher than average.

Dr. Myers considered that some people had argued before this Inquiry that *"the only acceptable risk in uranium mining is zero. This is certainly a laudable goal but strict adherence to this principle would* *eliminate the practise of medicine, coal mining, fishing, agriculture, industry and indeed of all the other activities in our society which have resulted in increased prosperity and increased life expectancy for Canadians."* He noted that coal has greater adverse impact on health than does nuclear power production.

He referred to the presentation of the Community Health Committee of the Medical Society of Nova Scotia, and their statement (he called it a suggestion) that "we maintain the belief that uranium mining would be an unacceptable health risk for Nova Scotians". He considered it was not clear on what basis the Committee had made its comparison. I.C.R.P. had suggested a reasonable basis of comparison would be that of other occupations which are recognized as having high standards of safety.

Dr. Myers' brief contained five pages of references. He used the interesting and helpful technique of using the name and year in his text immediately after the conclusion or statement he was making. There were four figures, including one dealing with occupational fatality rates in mines and uranium mines.

CANADIAN NUCLEAR ASSOCIATION - BRIEF

209. DR. FRANK N. McDONNELL

The immobilization and disposal of nuclear fuel waste deep in a stable crystalline rock body in the Canadian Shield were the main subject of a report by DR. FRANK N. McDONNELL of atomic Energy of Canada Limited to the Inquiry. Dr. McDonnell has expertise in research and development of radioactive waste management and heavy water. The report contains 57 references to studies.

(Since there are no plans to build a nuclear power reactor in Nova Scotia, and the present Government has stated its policy not to do so, the paper is somewhat academic. The Inquiry however does consider that the studies reported might shed light on solutions for the problems encountered at the start of the uranium exploitation cycle - that is, control of radio-active pollution at the mining and milling stages.)

CANADIAN NUCLEAR ASSOCIATION - OVERVIEW

210. DR. NORMAN ASPIN

The Canadian Nuclear Association was formed in 1960 to promote the development of nuclear energy for peaceful purposes. It has 210 corporate members - one third public sector and two thirds private. These members engage in fundamental research, nuclear power plant operations, exploration and mining, storage of spent fuel, production of radionuclides for medical use, and manufacture and construction of nuclear power stations.

Its President is a radiation physicist, DR. NORMAN ASPIN. CNA has organized many seminars and conferences on nuclear issues, and *"it is in this spirit of open discussion of the benefits and risks of nuclear power that we appear today before this uranium inquiry."* The presentation noted the heavy water plants at Glace Bay and Port Hawkesbury now were active members of the nuclear industry, producing 800 tons per year and employing over 700 people. Elsewhere in the Maritimes a CANDU power station had opened at Point Lepreau, New Brunswick, and a second unit there was being considered. In Halifax, Dalhousie University has a 'Slow-poke' reactor in its medical and environmental research programs. At Moncton, New Brunswick, Combustion Engineering employs 170 workers to fabricate CANDU nuclear fuel. These, plus this Inquiry as to the future promise of Nova Scotia as a uranium producer, made the *"Atlantic Provinces ... active participants in Canada's nuclear industry."*

Nationwide the industry employed more than 38,000 people who generated an economic activity of $4.3 billions. The front end of the fuel cycle (uranium exploration, mining, refining and fabrication of fuel) employed 8,100 who generated revenues of $867 million.

As a commodity its single end-use in Canada was in civil nuclear stations. Commercially, it was price inelastic and because of its nuclear weapons potential, subjected to considerable government control. *"It now appears that the world has abundant supplies of uranium to meet its needs at least until the turn of the century. Uranium is a finite resource, however, and ultimately steps will have to be taken to extract more of its energy. The present 'once-through' fuel cycles utilize only 1% of the energy content of the uranium."*

Canadian government policy required that all uranium have a peaceful end use. More than 80% of Canadian uranium was exported and enriched to fuel light water reactors. The development of the CANDU (Canada-Deuterium-Uranium) reactor was reported. Its performance as compared with other countries was impressive. *"Ontario Hydro's nuclear employees have been much safer at work than when not at work."*

There had been more than 20 public inquiries in Canada since 1975 (including this one) and the specific criticisms have not deflected the overall recommendations and findings. *"We recommend that future* *public inquiries be specific to sites or projects,"* that is start with a review of all the previous testimony and concentrate on the specific project.

The Association considered that the attitudes of Canadians with respect to nuclear power had altered very little over a decade, being half for the development of nuclear power, one quarter opposed, one quarter with no or intermediate position. (The accident at Three Mile Island altered this division for about one year.) *"Certainly the nuclear industry has been under the microscope of public scrutiny as has no other industry or institution in recorded history."*

The brief contained a list of 15 nuclear related inquiries in Canada. Its purpose was to supplement the earlier submission of Kidd Creek Mines. It emphasized again the safety of CANDU.

The summary contained this point about the time frame to develop a mine: In the early days it took 18 months for a 6,000 ton per day mine, *"an incredible achievement"*, but early mines operated under regulations which were inadequate. *"Operating practices and regulations have changed dramatically. Today, it takes 10 years to bring a similar capacity mine into production due to the detailed care and planning for safety. To fully appreciate these improvements we suggest that you visit the uranium mining community of Lake Elliot Lake, held up as everything that is wrong."*

211. DORIEN A. FREVE - BRIEF

A 20 year moratorium on mining of uranium in Nova Scotia was recommended by DORIEN A. FREVE. This would give the industry the time to deal with the long term aspects of tailings management and to find a mining process which does not add to environmental pollution. *"The monetary value ... will be much higher and therefore more beneficial to Nova Scotia."*

The main body of the brief dealt with the higher incidence of cancer to be expected. The Canadian Cancer Society has suggested that approximately 80% of cancer was preventable and also was due to factors in the environment. He quoted studies of the Atomic Energy Control Board, about the releases from mining and milling tailings, and concluded that the mine would add environmental pollution during the active life of a mine and it would not be until 1991 before the Board could know whether the contaminants could be retarded after the mine was closed.

"The fact that medical research has attained a high cure ratio does not and should not in any way absolve an environmental polluter nor justify their adding to environmental pollution."

(Twenty references).

MEETING NUMBER FORTY - OCTOBER 1, 1982

ST. MARY'S UNIVERSITY, HALIFAX

This meeting and the subsequent one considered five presentations on behalf of ECOLOGY ACTION CENTRE of Halifax. It was incorporated under the Societies Act of Nova Scotia in 1971 as a non-profit organization and is registered as a charity. Its purposes are *"research, education and action projects involving the preservation or improvement of environmental quality,"* more especially in Nova Scotia but with global and long-term perspectives implicit. It has a full-time staff of two, one part-time member, a Board of Directors which meets monthly and is elected annually by some 600 members, and it operates a non-lending library. Major issues are dealt with by semi-autonomous committees.

ECOLOGY ACTION CENTRE - BRIEF

212. DAVID VANDERZWAAG

The Nova Scotia Department of Mines and Energy had almost total regulation of uranium exploration, and the Minister had *"broad discretion"* under Section 8 of the Mineral Resources Act. The Department of the Environment had drawn up no regulations, and left inspection of exploration sites to inspectors of the other Department.

To DAVID VANDERZWAAG this raised two serious questions - Mines Department having conflicting tasks for industrial promotion and regulation, and the strength of its licenses.

Mr. Vanderzwaag, whose expertise is in law, also raised a series of questions about requirements in the regulations, without providing alternatives except the suggestion of *"strict requirements for building design"* for core storage and the posting of a bond. He recommended that there be a stronger stance by the Department of the Environment, including critical review by its Environmental Control Council, and *"the Department of Health should establish independent regulations for safety."*

He also considered that some forum must be provided for information giving and conflict resolution when there were to be major ground disturbances. To carry this out, he suggested three months notice of an application for special license, placing plan information at places convenient to the public, meetings at which questions could be asked of industry, and the three Departments - Environmental, Health and Mines, and public hearings before the Environmental Control Council or an independent panel *"in case of substantial land use conflicts or in case of serious environmental hazards."*

He turned to the question of burden of proof. The Public Inquiries Act was silent about it, and the Supreme Court of Canada would not specify how an inquiry was to be conducted. Procedures would have to evolve from *"commonsense and policy considerations."*

He saw two arguments against imposing a burden - it was fashioned by judges to assist them with adversarial judicial proceedings *"where the court must declare a winner and a loser,"* but here the Inquiry did not have to make a final decision, and some other inquiries had foregone such burdens.

The opposing arguments were three-fold - the Inquiry is very much judicial in nature, Cabinet would almost certainly follow its recommendations *"given the high profile and prestige,"* and there must be an essential legal tool available to decide whether, for example, tailings control technology is adequate.

His own conclusion was that there should be use of a burden of proof, since winners and losers would be created, and the burden should be on the proponent companies. Some legal literature had developed the theme that the burden should be upon those who might cause or threaten environmental harm, rather than the person or public threatened.

In civil cases the burden is usually on the person asserting a proposition. If there be error it should be on the side of health and safety.

Various parties should, before phase 2 of the Inquiry, meet to iron out the procedural format.

There were 14 references.

ECOLOGY ACTION CENTRE - STATEMENT

213. LESLIE GRIFFITHS

The lack of long-term tailings disposal regulations, the opinion that Saskatchewan labour-management relations were better than those in Ontario, and the need to study Federal-Provincial relations at the second stage - all as they related to uranium - were advanced by LESLIE GRIFFITHS. No written brief accompanied her short speech.

214. ECOLOGY ACTION CENTRE - STATEMENT

SUSAN HOLTZ

The prospects of uranium use in Nova Scotia for energy, and some implications of developing the industry in Nova Scotia, were developed by SUSAN HOLTZ. Her conclusion was that a long moratorium or outright ban should take place.

"It should be stressed ... that the usefulness of nuclear power is the major social benefit that can be claimed." Risks should not be undertaken if there could be an alternative to supply an essential need. It had been argued in the 70's that there had to be nuclear reactors to supply electricity, or no electricity at all. Part of this concern arose from OPEC's dealings with oil.

One reaction was for people to turn to the alternatives, a major one being the soft energy path. Conventional forecasting was based on projections of historical trends. The soft approach emphasized *"greatly improved efficiency and a long-term phasing in of renewable energy supply sources ... because these technologies move societies in the direction of certain values."*

She reported on studies in this and other provinces. The overall pattern of energy growth would increase through 2,000 A.D. and then, however, start to decline.

One reason would be the re-design of houses, cars and machinery so that they become more energy efficient. The second result of her study showed that the relative importance of electricity as a form of energy would increase but mainly because it would be part of a smaller energy pie - the actual demand would increase, if at all, only slightly.

Recent trends indicated growth rates for electricity and refined petroleum products have dropped and for gasoline sales had reversed itself. Uranium production capacity greatly exceeded demand and would for at least 20 years. The alternatives would be to have a marginal industry in Nova Scotia that might require subsidies or else a stepped up arms race which would increase world demand. The provincial Department of Industry, with *"good intentions"*, was not able to avert the environmental problems created by the Yava lead mine in Cape Breton which was forced to close because of economic hard times. Ms. Holtz did not think it could do any better with uranium development.

MEETING NUMBER FORTY-ONE - OCTOBER 6, 1982

ST. MARY'S UNIVERSITY, HALIFAX

215. ECOLOGY ACTION CENTRE - BRIEF

ELIZABETH E. MAY

Health hazards from uranium and particular attention to the debate over the effects of low level radiation were the main themes in the presentation of ELIZABETH E. MAY, Chairperson of the Uranium Committee. She endorsed the brief of the Valley Medical Society and of Dr. William Thurlow.

A description of the uranium atom, with its 92 protons and 146 neutrons, led off. It was its tendency to fall apart or instability that is the phenomenon known as radioactivity. Several pages were devoted to an explanation of energy transfer by the ionizing particle. Alpha particles were 10-20 times as effective in producing biological effects when compared with other kinds of radiation. It was often pointed out that they could be stopped by a sheet of paper, but this was because they transferred all their energy in the thickness of the paper.

There was initially a lack of awareness of the risks of radiation exposure. A Nova Scotian physician, Dr. Ian MacKenzie, was one of the first to connect ionizing radiation to breast cancer. His findings were reported in the British Journal of Cancer. The radiation had come from examination by fluoroscope of patients who were suffering from tuberculosis. Their rate of cancer was 24.5 times higher than for women who had not received the treatment.

This study, published in March, 1965, prompted studies of breast cancer in the survivors of Hiroshima and Nagasaki. In one study, radiation in small amounts over a period of time; in the others one large acute dose. *"Both studies supported in linear dose-response. In other words, that the induction of breast cancer was proportional to the radiation dose."*

In her view the theory had been abandoned that there is a threshold for radiation, that is, a dose below which no harm could occur. But there were experts who argued that the effect at low levels is insignificant. She quoted experts to conclude that the linear hypothesis underestimates the risk from low level radiation by high LET radiation such as alpha particles. (LET is defined as Linear Energy Transfer, of the amount of energy-ionization plus election excitation transferred per unit of path travelled by the particles.)

The experts she relied on also pointed out that some sections of the community are far more sensitive to radiation than others. (Fetuses more than infants, more than older children, more than adults.)

There should be investigation and study of genetic effects in children of uranium miners and on aging effects in uranium mining communities or others exposed to low level radiation.

Her brief concluded with a discussion of lung cancer among miners and the effect of changes in ventilation practices and requirements to wear respirators in certain areas. Lung cancer persisted despite reduced levels of exposure.

Ms. May's brief lived up to her promise to avoid repeating information already presented. There were 32 references.

216. ECOLOGY ACTION CENTRE - BRIEF

RONALD H. LOUCKS

The argument that uranium tailings were more of a people problem than a technical problem was advanced by RONALD H. LOUCKS. In dealing with tailings management, the odds of things going badly were sizable in his opinion. He considered much of this arose because of the poor and obsolete attitude in the industry. Its practices should be *"completely rethought."*

He went through the proposals by Kidd Creek Mines and examined them in the light of the critique of Ralph Torrie. Mr. Loucks points of *"household"* concern were five-fold:

1) that industry must ensure that no additional dose of radiation be added to that already existent from sun, soil and rocks, etc;
2) proposals should guarantee such isolation for as long as a potential danger is posed;
3) the site location should be chosen for long-term environmental, geophysical and geochemical containment capabilities rather than on engineered systems (he did not put the matter quite in this language but his decision did suggest that all engineered systems had a poor record of performance);
4) *"shouldn't the waste handling system be integrated into the design of the mine/mill complex or is it sufficient to use ad hoc designs?"*

He argued that a whole new attitude, embracing research, social awareness and long-term responsibility, is called for;

5) what costs can the industry be reasonably expected to occur? Advanced approaches according to Torrie would not cost more than 10-20% of mill product price.

He noted the possibility that thorium-plutonium fuel would be adopted in CANDU reactors and the thorium tailings would become economically viable for reprocessing. There were six references and a figure showing seven tailing containment methods.

The Centre included its presentation with the Ian Ball film of the National film Board, "NO ACT OF GOD."

The principal points have been noted in the digest of Mr. Ball's presentation.

MEETING NUMBER FORTY-TWO - OCTOBER 7, 1982

TRINITY - ST. STEPHEN'S UNITED CHURCH HALL, AMHERST

217. FRANCES B. KELLY - BRIEF

Opposition to uranium exploration, mining and milling, and end uses was stated by FRANCES B. KELLY. Health and environmental risks and arms buildup outweighed any gain. He found unanswerable the question *"why mine uranium?"*

He outlined the Canadian contribution which started with the Manhattan Project and our international dealings since, said all three major political parties in Canada have endorsed nuclear technology in the past, and considered the history of uranium development in Canada to be tainted.

Hidden costs included those of waste storage and subsidies. Reactors produced plutonium, and each 1000 megawatt reactor could produce 250 kgm. annually, enough for 20 nuclear weapons. This substance was extremely toxic and *"one pound evenly distributed throughout the world could destroy all human life."* A second major use was in nuclear weapons. The Soviet Union and United States have enough weaponry to destroy every city on earth seven times over, and, combined, enough to provide the equivalent of 12 tons of TNT for every person on Earth. *"If one accepts that peace will come from military strength then surely we should be at peace now."*

The uranium industry has directed $30-$35 millions into Nova Scotia since 1976 but Nova Scotia should look beyond this figure because of the problem of dealing with radioactive wastes. An NDP premier had said, in justifying his province's heavy investment in the uranium industry, that *"we have simply had to make a leap of faith and assume* *that a satisfactory means of disposal will be found."* (Mr. Kelly was referring to the then Premier Allan Blakeney of Saskatchewan.) There were also non-radioactive wastes such as nitrates and sulphates. There were the health risks. AECB and ICPR were attacked. The choice was likened to Robert Frost's poem that:

> *I shall be telling this with a sigh*
> *Somewhere ages and ages hence:*
> *Two roads diverged in a wood, and*
> *I took the one less travelled by,*
> *And that had made all the difference.*

(The brief contained 43 references and a page of bibliography).

218. JENNY ORE - BRIEF

As a farmer from Port Howe, she was concerned with the "spin off" from uranium mining. Not that connected with jobs, said JENNY ORE, but *"multiple effects which arise when heavy metal radiation enters our food chain."*

The pathways carrying radioactive waste would affect the flora and fauna, and the animal and plant biochemical pathways would be incorporated into our food chain. Her brief concentrated on what would happen if a nuclear power plant were established and relied heavily on "Poisoned Power" by Dr. John W. Gofman and Dr. Arthur R. Tamplin. She related a conversation with the former.

She considered that coal, solar, wind and tidal power were sufficient to satisfy our needs, supplemented by energy efficiency and conservation practices. More recycling of aluminum would save energy. She was opposed because *"our land is our wealth and as a farmer I shall do* *all I can to preserve it."*

(Five references).

219. REV. PETER MITCHELL - REFERENCE

The Minister of the meeting's host church, Rev. PETER MITCHELL, had opened the hearing with a prayer. Then he returned to read into the record material considered at the 29th General Council of the United Church of Canada which took place in Montreal in July.

Energy and Justice was the particular theme. *"In a just society everyone would have access to the energy sufficient to meet their basic needs."* There should be fairer distribution between rich and poor people and countries. There should be top priority to the development of renewable energy. *"A sustainable society must attach prime importance to all the risks and injuries caused to both human beings and to nature by its activities and consumption of energy."* These particular quotations came from the World Council of Churches.

In Canada, the United Church of Canada has advocated a moratorium on further expansion of the nuclear industry and on the need for a national inquiry. The Energy sub-unit of the Church argued that the *"energy problem is primarily a question of equitable distribution and appropriate use of finite resources rather than the production of increasing supplies."* It called for commitment to renewable supplies - direct solar, wind, bio-mass, ocean, geothermal energy, hydro-power and organic wastes.

The General Council had adopted a recommendation that Federal and

Provincial Governments calling for a *"major shift towards the development of the huge, largely untapped, potential of soft energy options, including conservation."*

Reverend Mitchell in conclusion said his church favoured a holistic approach. It was not enough to ask if a project were possible, but also there must be asked the alternatives, the costs, including that to the environment. *"An emotion-based rejection of nuclear power is also not a realistic option."* Health, pollution, conservation, and the funding and development of small scale, locally initiated sustainable energy projects might better serve Canada than the intensive headline attracting projects on the national news.

220. GRETCHEN FRESIA - STATEMENT

Uranium mining would leave the province with *"mess and risk long after those mining companies have taken their profits and gone,"* according to GRETCHEN FRESIA, a schoolgirl, *"and its the younger generation that will have to deal directly with these problems."* Her short speech concluded: *"is it worth the risk?"*

221. BERYL A. MacDONALD - STATEMENT

As an Amherst lawyer, she considered that she had no expertise but BERYL A. MacDONALD did not believe that she had to be an expert to deal with questions of the exploration, mining and uses of uranium. The disaster at Three Mile Island had brought about this change of mind. She formerly supported the nuclear establishment but now withdrew her support.

She considered that there were five unrealistic assumptions concerning the uranium industry:

1. *That technology can solve any and all problems;*
2. *That mechanical failure and human error will not occur or that if they do occur the failures and errors will not be serious;*
3. *That if the chance of a major accident is minimal, then it is statistically irrelevant and can be ignored.*
4. *That an "act of God" will not occur which could adversely affect a mine, reactor, or a waste disposal or holding site;*
5. *That no terrorist group will obtain and make use of the by-products of the uranium processing cycle to threaten national or international security.*

As a realist she could not make any of these assumptions. Ms. MacDonald also considered the risks from radiation exposure, and the uses as a fuel and in weapons, and asked that politicians start initiating a truly educational debate.

222. COUNCILLOR IRA DRYSDALE - EXPERIENCE

A 10 year representative of the Wallace and Wentworth area on Cumberland County Council, and a farmer and storekeeper, IRA DRYSDALE reported on the concern of his constituents. It arose because of the high content of uranium in wells, and the extensive exploration for uranium.

In 1975, a Federal-Provincial program reported relatively high radiation levels in well water between New Glasgow and Cape

Tormentine in New Brunswick with the highest level at or near Baie Verte, Pugwash, Wallace, Tatamagouche and River John. There was increasing concern about the effect on health.

Over the past six years the exploration had occurred and Gulf Minerals in 1979 reported it was convinced of the probability of economic mineralization in the Cobequid uplands. Parts of the exploration took place close to the Wallace River, which rises in Folly Lake and flows North from the Cobequid.

"The question concerning residents in the whole North shore area is to what extent radiation levels are increased by any disturbance of the environment, whether it be mineral exploration or the more conventional activities of excavating gravel and stone, the clearing of forest roads or agriculture practices." That assessment was beyond the capabilities of individual or groups, but was clearly that of environment authorities in government.

He considered that there was clear proof of a relationship between naturally occuring radiation and cancer. *"It is a fact that for several years there has been a nagging, haunting suspicion in the North-Cobequid communities of Wentworth and New Annan that too many people have fallen victims of cancer in one form or another."* Uranium development would be greeted as a threat by those who already feel exposed to a health hazard. Another fear was the eventual construction of nuclear power plants. *"Government should come to terms with this concern."*

Councillor Drysdale turned back the clock to his teens. As a 19 year old he worked in Uranium City, surface and underground, for 10 months for Eldorado Mining and Refining Limited. Everybody had become dependent on one company, including Indians who had given up their way of life, and with the mining town having folded up it was difficult to imagine what would happen to them now. At home in Cumberland County, one knew in Springhill, Joggins or River Hebert what happened when mines closed. He was not in every case opposed to mining, but one had to consider that *"what is best for a community in the long run is not always capable of being measured in initial jobs and financial returns."*

His summary was:

1) Nothing be done in exploration and development which would aggravate radiation contamination already in the water;
2) the use and where uranium would be used should be established to the general satisfaction of the community, and
3) the long range future of any development should be established in relation to social and economic interests. The Nova Scotia government should go easy, not hurry.

A slide presentation followed. No authorship was claimed at this meeting, but subsequently two groups - one in Amherst and the other in Halifax - claimed it. The groups did not seem to be related except in political philosophy , which was violently opposed to the Commissioner and the Inquiry, and the beliefs of more than 99% of the people living in Nova Scotia.

MEETING NUMBER FORTY-THREE - OCTOBER 7, 1982

CUMBERLAND COUNTY, BAND HALL, PARRSBORO

This was the final hearing outside Halifax, and turned out to be one of the most pleasant. The participants had formed E.P.I.C.S. or ENVIRONMENTAL PROTECTION IN CUMBERLAND SOUTH, to put distance between themselves and certain elements who had caused concern among the responsible section in the anti-nuclear movement in Nova Scotia. E.P.I.C.S. provided a chairman for the meeting because of the Commissioner's laryngitis, and the evening was topped off with a presentation of yellowcake and refreshments. The Commissioner is indebted to E.P.I.C.S. and thanks CONRAD BYERS for his excellent management of the meeting. The Association was formed under the Societies Act of Nova Scotia.

223. GORDON CAMPBELL - E.P.I.C.S. - SONG

The song "OLD WAYS" was presented by MICHELLE RYAN and PAUL CLARKE. Its lyrics and music were by GORDON CAMPBELL.

"Our ways made our living
Your ways bring dangers
Our way we work together
Your ways make us strangers
Strangers in our land."

224. MICHELE RYAN - E.P.I.C.S. - STATEMENT

The real costs of uranium mining would have to include treatment of miners for uranium-induced lung cancers, according to MICHELE RYAN. This cost would manifest itself after the ore had been mined and the company gone.

She entitled her presentation "The Real Cost" and brought some new arguments to the continuing argument over health hazards: Families would have to be supported after workers had died, there would have to be maintenance of children born with genetic defects, and there would have to be *"increased research funding once the magnitude of the problem becomes blatantly evident."*

Ms. Ryan considered that *"the taxpayer can expect to pay $300-$400 each day for the treatment of a hospitalized uranium worker."*

It cost $5,000 to maintain a mother and one child per year. The cost of research could not be estimated but after billions of dollars on cancer research we do not have all the answers. The costs become frightening when one considers how to contain and maintain radioactive waste for 400,000 years.

225. Dr. HOWARD GOLDSTEIN - E.P.I.C.S. - BRIEF

Does the technology exist for safe and permanent disposal of wastes? Dr. HOWARD GOLDSTEIN asked that question and answered *"without a doubt, the technology definitely does not exist for safe permanent disposal of radioactive wastes."*

Tailings retained 85% of the initial radioactive material mined, and because they contained elements like thorium-230 with a half life danger of 76,000 years *"they are hazardous practically forever."*

He considered that over 25 years it was two to one that a pond or dam will fail to contain tailings, and a 50% probability that these failures will pollute a water course. Reference was made to Serpent River, Ontario, and Churchrock, New Mexico. The Royal Commission on

Electric Power Planning in Ontario recommended expansion of uranium mining only upon demonstrated progress in solving the tailings problem.

In Newfoundland a Board of Inquiry had concluded that there was no safe method for handling mine waste, and the British Columbia Commission has concluded that a walkaway disposal is not possible with current technology.

A uranium mine in Nova Scotia would be near farmlands and dense human populations. There would be a hazard to pastureland, blueberries and other crops.

226. MICHAEL FULLER - E.P.I.C.S. - SONG

"The Planners" by MICHAEL FULLER was sung by MICHELLE RYAN and PAUL CLARKE.

> *"Everything's easy*
> *Everything's fine*
> *We'll look after mother*
> *When we open the mine."*

227. CONRAD BYERS - E.P.I.C.S. - COUNTERPOINT

A counterpoint presentation of slides featuring Parrsboro and Elliot Lake, Ontario, took place with commentary by CONRAD BYERS.

Dr. A. ELMIK - E.P.I.C.S. - READING

The resolution of the Nova Scotia Medical Society regarding uranium exploration and mining was read by Dr. A. ELMIK.

228. KATHRYN ARCHIBALD - E.P.I.C.S. - BRIEF

Some of the health risks associated with exploration and mining for uranium were dealt with by **KATHRYN ARCHIBALD**. *"The period of time involved* (for radiation decay) when compared to *the lifetime of a generation is virtually forever."*

The standard concerns were noted. She considered that radon gas (which gives off alpha radiation of particular concern) could travel 1,000 miles before it decays and was highly toxic.

"In Nova Scotia we need more controversies engendered by doctors, nurses and other health professionals, dedicated to the practice of preventative medicine and the removal of radiation's biological hazards from the environment."

229. MICHAEL FULLER - E.P.I.C.S. - STATEMENT

The moral and ethical issues from the mining of uranium in Nova Scotia for shipment abroad were raised by MICHAEL FULLER. *"Do we have the right to condemn the future generations for half a million years to carcinogenic exposures ... for a handful of jobs that as a society we are not even dependent upon today."*

Radon would travel 1,000 miles down-wind. Nova Scotia could not control the wind, but it could control whether or not to mine. He drew a rather graphic description of death by plutonium induced cancer of the lung, followed by cremation, and *"it would be possible for someone to inhale that same plutonium particle from your smoke and thus start the whole terrible cycle over again."*

E.P.I.C.S. for the official record called for an unconditional ban on exploring for and mining of uranium.

230. CONRAD BYERS - E.P.I.C.S. - SLIDES

Slides of the Wentworth uranium exploration site were presented by CONRAD BYERS.

231. MICHAEL FULLER - E.P.I.C.S. - SKIT

The creative MICHAEL FULLER wrote and produced "The Uranium Dilemma" which starred BERNICE ANTRIN as Captain Enviro, Fuller as the mining man, and a chorus of MICHELE RYAN, KATHRYN "KATHY" ARCHIBALD, PAUL CLARKE and HOWARD GOLDSTEIN.

A sample:

Mining Man (with sample of uranium ore):

"I tell the students and the
teachers that the only way that
this can hurt you is if you drop
it on your little toe!
that usually gets a big laugh
from all hands.
Chorus: *Ha ha ho ho hee hee*
That's not responsibility."

232. MICHELE FULLER, MICHELE RYAN and PAUL CLARKE - E.P.I.C.S. - SONG

"The Children's Song" by MICHAEL FULLER concluded the meeting. It was sung by MICHELE RYAN and PAUL CLARKE, who had also composed and arranged the music.

"We want to grow old
To have babies of our own
We don't trust what we've been told
By the bare faced mining man ..."

MEETING NUMBER FORTY-FOUR - OCTOBER 8, 1982

BURKE EDUCATION CENTER, ST. MARY'S UNIVERSITY, HALIFAX

233. DEPARTMENT OF ENVIRONMENT, PROVINCE - BRIEF

"The Nova Scotia Department of the Environment neither supports nor rejects the concept of uranium mining and milling in Nova Scotia but recognizes that a number of important environmental issues need to be addressed prior to any decision to proceed with uranium mine development in this Province." This was the preface of the (then) Deputy Minister, E.L.L. ROWE, to his Department's presentation. His officials would deal with pollution and control, regulatory and non-regulatory mechanisms, specific Nova Scotia environmental factors, and specific management concerns. The site specific capacities were also considered.

Mr. Rowe was assisted by JOHN JONES, Director of Water Planning and Management, and ALAN CARROLL, Director of Division Utilities. The 43 page brief included four pages of bibliography. Its conclusion was set forth on page 40:

> *"Before any development of the resource begins in this Province, it is very clear that management issues be resolved, i.e., that clear environmental management and regulatory authority be established for all phases of uranium mining and milling; specific procedures be instituted for close-out and abandonment; and a mechanism be put in place to ensure funding for long term waste management. The Department of the*

> *Environment intends to play an important role in protecting the public interest at large and looks forward to any direction and advice that the Inquiry may wish to offer in this matter.*

For convenience, the digest of this major brief will follow the heading of the five sections.

234. CONTAMINANT SOURCES AND ENVIRONMENTAL CONTROLS (JONES)

Uranium mining had some potential environmental effects which were common to other mining activities, including heavy metal leaching, acid mine drainage and mine site land alterations. The principal difference was the release of radio-nuclides during operation and after shut down.

"Current pollution systems and active management practices appear capable of ensuring that these releases remain within established environmental and health standards. Given the long half life of a number of parent radio-nuclides however, (e.g. Thorium-230 at 80,000 years and Radium-226 at 1,620 years) these measures must eventually give way to natural environmental systems for the ultimate control and alternation of contaminant releases." Much would depend upon the natural conditions at specific mine sites in Nova Scotia.

Exploration - Environmental effects from trenching, line cutting, and drilling were not considered significant when appropriate pollution control measures are followed. The Bates Commission had, for example, reached this conclusion. Failing adequate supervision and control, there were potential for increased radon emissions from open trenches, and possible contamination of water by interaquifer communication along drill holes. In Nova Scotia, environmental control was exercised through conditions in the special uranium exploration licences, which require companies to conduct pre and post radiological surveys, infill trenches and cement grout holes. (See later under Management Concerns).

Operation - Available technology and management practices can effectively control most emissions and effluents, but there were four specific areas of concern:

1) Nitrogen compound releases - these could be toxic to aquatic biota at relatively low concentrations and could eutrophy surface water at elevated concentrations. Since the late 70's there has been intensive research, and a number of alternative milling processes designed. *"Whether such alternative milling methods need be considered for proposed uranium mining and milling operations in Nova Scotia will depend upon site specific studies of receiving water characteristics. It is worth noting, at least with respect to nitrate releases, that it is doubtful this would have a significant effect upon most surface water bodies in Nova Scotia. It is generally conceded that nitrate enrichment is not the limiting factor for eutrophication in many parts of the Province."*

2) Radium renewal - in Canada effluent releases from the tailings basins may exceed five tonnes of water for each tonne of ore processed; and often contain radium-226

activities up to two orders of magnitude above the Federal standard of 10 pci/L dissolved. Some form of radium-226 removal must be practiced. The method currently employed is coprecipitation with barium sulphate but this presents concern about the presence of B a (Ra) SO_4 precipitate in settling pond discharges. There was an absence of any specified limit for total radium by AECB or Environment Canada and the Province, as Saskatchewan had done, might have to set a Provincial standard.

3) Seepage - this is always a potential problem in temperate climates. In Canada, control relied upon containment and the use of geological, clay or synthetic liners. Because all liners possess a finite permeability, seepage was inescapable; and there could be the human factor of improper installation, and possible rupture and degradation over the long term. There would have to be monitoring and contingency planning.

4) Radon and particulates - tailings impoundment were of greater concern than mine ventilation exhaust in the short term, and would continue as a problem after close out. *"Based on theoretical calculations of the expected radon flux and rate of atmospheric dispersion it has been determined that the average radon concentration at a distance of 1-2 km. from a typical*

> *tailings area would be indistinguishable from background levels."* Above impoundment areas the level would be above the Federal standard for public exposure. Access could be controlled during operation but such isolation may be difficult to achieve after abandonment. Control measures would be required, such as moist soil cover of three metres used in the Southwest United States.
>
> Dust suspension and transport have not been studied extensively in Canada. Dust dispersion over a short term is not usually considered to be a significant factor in Canada, but measures will be required to ensure against long term erosion. One possible solution would be revegetation but this might result into *"radio-nuclide uptake by the vegetative cover and possible subsequent incorporation into the food chain. Research into the potential significance of these transport mechanisms is required."*

Abandonment - this was the most significant concern associated with the uranium cycle. *"The steps required for the safe total abandonment of these sites are not yet known."* Some of the specific problems were: alternation of tailings water chemistry making them more mobile (largely attributable to the potential for a reduction in tailings water pH), redissolution and release of radium from barium radium sulphate sludges (precipitation ponds are not suitable and placement from ponds to tailings area while suggested as a preferred option but *"further research is required to ensure confidence* *in this mode of disposal,"* and dam failures and erosion (progress had been made in the short term but *"over ... thousands of years erosion and transport of tailings is inevitable."*)

"Under current practices 85% of the total radioactivity contained in the ore is discharged with the tailings which may be expected to contain about 5% of the uranium originally present and more than 99% of the radium-226 and thorium-230. Given the slow decay rate of radium and thorium and typical concentration levels in mill effluent discharged to tailings (2-3,000 pCi/L total radium-226 and 70,000-360,000 pCi/L total thorium-230), by present standards the level of activity after 100,000 years would still be too high not to require isolation."

Possible solutions were removal of thorium-230 and radium-226 during milling to criteria for site selection appropriate for natural and safe dispersion and attenuation. AECB was confident that necessary steps would be determined in the near future. The National Technical Planning Group on Uranium Tailings, formed in 1980 from governments and agencies, producers, universities and provincial research organizations, estimated that more than a decade was needed. If uranium mining were to proceed before these effective long term disposal techniques were defined, *"tailings site selection and close out procedures must be based on the assumption that the natural environment will act as the ultimate guarantor for effective pollution control."* This naturally led the Department to note specific concerns.

NOVA SCOTIA ENVIRONMENTAL CONSIDERATIONS (JONES)

Pages 14-19 dealt with specific environmental factors. Of particular significance was the presence of exploration near towns and farm lands - Palmer Lake, Kings County, within 16 km. of Kingston - Berwick.

Aquatic pathways - *"the high annual precipitation rate"* (140 cm. in Nova Scotia, 79 cm. in Elliot Lake, 40 cm. in Northern Saskatchewan) *"and the limited surficial cover"* were noted. The high precipitation meant that there was an increased likelihood that tailings impoundments will intersect the water table, there would be a higher mine water infiltration rate than in other uranium mining areas, and an increased potential for erosion. The granitic terrain and its thin covering of sandy glacial till *"would have a poor capacity to attenuate or immobilize contaminants leached from a uranium tailings disposal area or from waste rock piles."*

In most potential uranium mining areas such as the South Mountain Batholith, groundwater moves along fractures in rock. This is difficult to predict, failing extensive subsurface drilling. There was limited chemical alternation - and it was likely that local (shallow) flow systems would predominate.

"The potential contamination of fracture flow systems is considered to be an important issue in Nova Scotia since, unlike most other regions of the world, fractured crystalline aquifers act as a source of water for approximately 70% of the Province. Therefore a detailed site specific and regional investigation of the hydrogeology and hydrogeochemistry, designed to investigate the significance of this pathway, should be conducted prior to any decision to establish a

mine or tailings impoundment."

The high runoff rates provided little opportunity for surface flow to become enriched in dissolved minerals, but they often contain brown coloured humic substances, and characteristically exhibit slightly acidic pH values.

There was little or no buffering capacity and the waters were prone to further pH depression. If pyrite mineralization were associated with uranium ore bodies in Nova Scotia, pH adjustment of tailings may have to be continued during mine close-out.

"A second consideration originates with the frequent high concentrations of organic substances in Nova Scotia waters. Organic molecules are known to sequester metals and other substances, frequently altering both their relative toxicity and mobility, however the effect of organic substances on radioactive elements is poorly understood. Studies specific to the Nova Scotia setting will be required therefore, to better understand the potential role played by humic substances in the complexing and transport of metals and radio-nuclides."

Detailed assessment of surface water and contaminant interaction would be needed because much of our water comes from highland areas where uranium projects are now being evaluated.

Atmospheric pathway - *"winds characteristically change more rapidly both in respect to time and space in coastal areas than they do inland."* This brought into question the calculated emission rates and atmospheric modelling elsewhere in North America. Maritime climate and uneven topography would have to be considered.

LEGISLATIVE MANDATE, RESPONSIBILITIES AND ACTIVITIES (CARROLL)

The Department is required to ensure that practical measures are taken to preserve the environment and to provide the best use of renewable resources. It did so through a mix of regulatory (Industrial Waste Control and Water Heights) and non-regulatory (data collection, interpretative capabilities and planning and inter-agency coordination) functions. Of the five Acts administered, two related to uranium mining, the Environmental Protection and Water Acts. A sample of the coordination was the joint Mines and Energy/Environmental Technical Committee dealing with the environmental concerns into the former Departments licensing for uranium.

The Department has three operational divisions, and expertise to deal with such areas as ambient air quality monitoring, environmental baseline data collection for major development proposals, surface and groundwater inventory, and planning and development of programs pertaining to solid and hazardous waste management.

Before a uranium mine mill facility could be started, it would require approval by the Minister. There would have to be a technical review which would include an environmental impact assessment. The assessment is provided in the two Acts previously mentioned.

The Environmental impact process is described as follows (the Inquiry has added the numbering):

1) Proponent submits project description;
2) Department decides whether there should be an assessment;

IF SO

3) Department may require further information;

4) In any event prepares specific terms of reference as guidelines, in consultation with the proponent;
5) Proponent undertakes required studies on physical and biological environment and forecasts the impacts on these environments;
6) The Environmental Impact Statement so prepared is reviewed by the technical review panel of the Department;
7) If deemed free of deficiencies a review document is prepared including recommendations regarding the environmental acceptability.
8) The Minister receives the review document *"and any comments from the public"*, and may: (a) approve, (b) disapprove, (c) require additional information, (d) add terms and conditions.

The Minister is required by Section 28 of the Environmental Protection Act to approve of all proposed undertakings that will or are likely to cause pollution. An Industrial Waste Permit Approval for control of all mine and mill effluent is required.

Examples of items approved under the Environmental Protection Act would be mine water discharge, design of tailings system and effluent treatment systems. Examples of items approved under the Water Act would be consumption ground and surface water use, and sewage treatment systems. To prevent complication all approaches can be dealt with by the Assessment Division which prepares a single Industrial Waste Permit. A separate approval would be required for division or drainage of surface water but this again is co-ordinated by the Assessment Division. *"Plans for operational monitoring, abandonment and reclamation of the mine, mill and tailings area would be approved at the same time as the major operational approval is carried out under the Environmental Protection Act."* There was interagency cooperation including normal incorporation of the requirements of other Provincial or Federal legislation or regulations, and required reviews.

Since the start of uranium prospecting and exploration in Nova Scotia, the Department had

(1) cooperated with Kidd Creek Mines Ltd. and the Environmental Protection Service to establish a detailed baseline data gathering program, both radiological and non-radiological, at Millet Brook.

(2) developed guidelines for uranium exploration.

(3) prepared a draft amendment to regulations under the Mineral Resources Act regarding *"all proposed exploration activities in municipal water supply water sheds."*

(4) taken part in the Provincial task force on uranium in drinking water, by providing sample collection, data interpretation and hydrogeologic studies.

(5) formed an interdivisional committee on uranium mining, which had collected a comprehensive library and invited the Inquiry to use the same and prepared reports on jurisdiction, air-borne effect, environmental concerns, environmental management concerns, and a review of general environmental concerns and waste management practices.

MANAGEMENT CONCERNS (CARROLL)

As a jurisdictional matter uranium mining and milling were declared to be works for the general advantage of Canada by Section 17 of the Atomic Energy Control Act. In practice, AECB worked on the principal of a Federal-Provincial responsibility for environmental management of such operations. For those who prefer legal language, a *de facto* state of concurrent jurisdiction *"while preserving a de jure state of exclusive federal jurisdiciton."* The practice then had become this at various stages:

Exploration - AECB issued an ore removal permit if and when 10 kg. of uranium or thorium ore in a concentration exceeding 0.05% grade were removed within one calender year in effect, the province had environmental management responsibility. By the terms and conditions of uranium exploration licenses, the Department received notice of programs, could evaluate and control, and, in cooperation with Mines and Energy, monitor exploration programs. *"Concern has been expressed to this Inquiry about the enforcement of the "terms and conditions" governing exploration activity because they have not been proclaimed as regulations under an act. Under the current procedure, special uranium exploration licences are issued as Orders in Council under the Mineral Resources Act.* * *Consequently, such penalties as provided in that Act would apply, given non-compliance with licence conditions. In the event a failure to comply with the*

* *Mineral Resources Act, S.N.S. 1975, c.12*

*"terms and conditions" results in Pollution, an additional enforcement capability exists under the Environmental Protection Act.**

Impact Assessment - AECB requires an Environmental Impact Statement before a mine-mill could proceed but had not set out a well defined process. In practice it relied on provincial assessment procedures. *"Consequently the opportunity exists for comprehensive public involvement within the Provincial process."* Section 17 (2) of the Environmental Protection Act empowered the Minister to authorize the Environmental Control Council to hold public hearings. Public participation has not been rigidly defined within the process, and the approach has varied from joint Federal/Provincial formal hearings to the simple release of the final impact statement.

Standard setting and Monitoring - the practise in other areas (Clear Air Act, Water Contaminants Act) was that the Federal government established minimum standards, *"generally done in consultation with the provinces who may wish to introduce more stringent standards."* It was not clear that AECB would use this approach with respect to uranium mining. *"This assumes particular significance in light of one concern that contaminant release limits must reflect Nova Scotia environmental conditions."*

Elsewhere, Saskatchewan has exercised concurrent jurisdiction by drafting its own Uranium Mining Pollution Control Regulations, Ontario has accepted the standards set out by AECB, and AECB (that is, the Federal government) had not accepted a maximum concentration limit (as Saskatchewan had done) but had adopted "as low as reasonably achievable" ALARA. Special reference was made to the Surface Lease

* See Section 26 Environmental Protection Act

Agreements in effect in Saskatchewan.

Regulatory Enforcement - usually provincial mine inspectors had been given special training and used to carry out inspections for AECB. The Bates and Bayda Commissions had raised questions as to whom the Inspector was representing or was accountable to. The Province might be forced to rely upon the Ontario practice of including provincial laws in AECB licensing requirements but from the standpoint of prosecution this would be cumbersome.

Responsibility for tailings Management - at present there is no agency in Canada to whom the custody of waste management facilities can be transferred. The Federal Department of Energy Mines and Resources had funded a study of possible management options, and Nova Scotia should consult the possibilities. There was as yet no Federal requirement for funds to be provided for monitoring and remedial work after close out. Saskatchewan had established a one million dollar fund for each new mill. *"Whether similar action need be considered in Nova Scotia should depend on the Boards willingness to require some form of economic guarantee as a condition for close out approval."* The answers should probably come from a Federal/Provincial forum, otherwise supervision would fall to the Province but the financial contest would be Federal.

CONCLUSION

The final portion of this major brief, page 36-40, cover the material previously set out in this digest and also the conclusion set out over the start of this digest. It is perhaps worthwhile noting this reference:

"The Nova Scotia Department of the Environment is concerned primarily with three areas of management responsibility for which clarification is required with respect to procedures and for authority" -

impact assessment;

standard setting and monitoring;

regulatory enforcement."

(slightly re-arranged by the Inquiry for emphasis).

The ten appendicis to the brief were contained in a separate volume. Their listing and number of pages are:

		NO. OF PAGES
APPENDIX A	(1) ENVIRONMENTAL PROTECTION ACT AND REGULATIONS (2) WATER ACT AND REGULATIONS	26
APPENDIX B	WATER PLANNING AND MANAGEMENT DIVISION ORGANIZATION AND FUNCTIONS	6
APPENDIX C	INSPECTION AND MONITORING DIVISION ORGANIZATION & FUNCTIONS	4
APPENDIX D	ASSESSMENT DIVISION ORGANIZATION & FUNCTIONS	6
APPENDIX E	ENVIRONMENTAL IMPACT ASSESSMENT PROCESS	11
APPENDIX F	GUIDELINES FOR THE PREPARATION OF IMPACT STATEMENTS ON MINING RELATED PROJECTS (1) GAYS RIVER PROJECT (2) LINGAN PHALEN MINE AND ALTERNATE #26 MINE	7
APPENDIX G	(1) INDUSTRIAL WASTE PERMIT APPROVALS PROCESS WITH EXAMPLE (2) WATER RIGHTS PERMIT APPROVALS PROCESS WITH EXAMPLE	43
APPENDIX H	MILLET BROOK BASELINE DATA COLLECTION PROGRAM	26
APPENDIX I	TERMS AND CONDITIONS GOVERNING SPECIAL URANIUM EXPLORATION LICENCES	8
APPENDIX J	BIBLIOGRAPHY ON URANIUM MINING & MILLING AND RELATED MATTERS	83

235. DEPARTMENT OF MINES AND ENERGY, PROVINCE - BRIEF

"No commercial deposits of uranium currently exist in Nova Scotia. Only one significant prospect has been documented to date, near Millet Brook in Hants County." This was the reality, based on present technical knowledge, of the uranium situation as seen by the NOVA SCOTIA DEPARTMENT OF MINES. The 61 page brief, plus six pages of references, eight Appendics and haul out map and two end maps make up the presentation. It is a major document.

The Deputy Minister, JOHN J. LAFFIN, and the assistant Deputy Minister, Dr. J.A. GARNETT, appeared before the Inquiry to present the work which involved many people in their Department. Singled out were George O'Reilly, Norman Lyttle, Janet Gillispie-Wood, Rick Ratcliffe, Dan Murray, John Fowler and Kathy Mills.

The brief notes the division of responsibilities - the Nova Scotia Department of Mines and Energy to regulate mineral exploration and mining, and the federal AECB to regulate special radioactive aspects involved in the mining and processing of uranium ore. *"The report is written for the interested layman, but some aspects assume the reader has some background knowledge of geological processes."*

HISTORY

Pages 3-9 dealt with the history of uranium exploration, sporadic until 1976, extensive to 1981. The first occurences were reported in the New Ross area by 1915, and near Georgeville, Antigonish County, about 1953. Geologically, they compared to commercial uranium deposits in the Bancroft area, Southern Ontario, but much smaller. Before 1976, in the northern mainland, uraniferous deposits were found in the copper sulphide deposits but were considered to have economic potential. Prior to 1975, exploration for uranium did not require a special license.

Early in the 1970's, the hypothesis of the Continental Drift (advanced by a German scientist during the First World War - R.J. McC) became a guide for the practicing geologists. *"It became clear that similar geological processes were active in parts of Nova Scotia and western and central Europe in the period 300-400 million years ago."* The possible similar commercial deposits were tin, zinc, silver and beryllium. In 1976, a well water survey had been carried out in Northern Nova Scotia, eastern New Brunswick and Prince Edward Island. *"Uranium, radon and radium contents of ground water had been recognized as a valuable tool in exploration for concealed uranium orebodies."*

The situation prompted many special licenses to be taken out. Interest which had come from the Cobequid Highlands, was triggered by the discovery of radioactive boulders, in a breakwater at Port Howe, Cumberland County. The result of an airborne radiometric survey of the southern mainland was released by the Geological Survey of Canada; and there was an exploration risk to the South Mountain batholith. The peak in acreage under licence for uranium was reached in 1977.

Some companies withdrew from exploration activities for uranium or put their effort into other minerals such as tin and tungsten. *"Although total uranium acreage for the Province declined, the uranium acreage staked within the South Mountain batholith remained at a constant high level."* Then came the moratorium in 1981.

The uranium assessment reports were described in the brief as:

"The Nova Scotia Department of Mines and Energy is responsible for the monitoring and approving of work done on all mineral exploration licences in Nova Scotia. Exploration activity is monitored on a regular basis by regional geologists. Technical assessment reports containing details of all physical and scientific activity performed on a mineral property must be submitted and approved on an annual basis as part of the licence renewal process. Such reports are also required for special uranium licences. All information relating to anomalous distribution of uranium, and its daughter products, are a necessary part of such reports. The assessment reports are required as part of the renewal procedure for all types of mineral exploration licences. Special uranium exploration licences require that a full report on all geological investigations conducted on the property be submitted to the Nova Scotia Department of Mines and Energy on an annual basis. As stipulated in the Regulations under the Mineral Resources Act (Section 8) assessment reports on exploration programs are maintained in confidential files for a period of two years from date of submission to the Department. When information is received documenting potential health and environment impacts, the appropriate agencies are notified. After the two year confidential period, or when the ground is dropped, all reports become non-confidential (open file) and are available to the public."

GOVERNMENT ACTION

The Mineral Resources Act gives responsibility for the issuing and renewal of mineral exploration licences, and for monitoring and approval of work done on mineral lands, to the Department. In 1975, the Act was revised to allow withdrawal of certain minerals from application for exploration licence and the result was that uranium was placed under special Order-in-Council agreements. *"This action enabled the government to know where and by whom activity was being carried out for uranium."* At first the only terms and conditions required were the submission of a work proposal.

The first indication that there might be something beyond the exploration stage came in 1979 when Aquitaine Co. of Canada Ltd. told the Department that a potentially sizeable uranium body might exist near Millet Brook. Detailed diamond drilling and other forms of ground disturbance would take place. A letter was sent to all exploration interests June 16, 1980 clarifying areas of overlap in licences, reminding of regulations regarding trespass, and notice that special guidelines were being drawn up. A "Notice to Landowners" was placed in regional newspapers advising of rights in relation to trespass by others. The first draft of Guidelines was sent to government agencies, explorers and an environmental group on September 23, 1980, and after their comments and input from the Nova Scotia Department of the Environment the second draft went out April 3, 1981. The guidelines became terms and conditions of licences by virtue of the powers provided by Section 24 (2) of the Act. Its effect was that the Provincial Government could *"revoke any licence if the Terms and Conditions ... were not met. In this sense the Terms and Conditions were more restrictive on licence holders than regulations, since the determination of adherence to the prescribed procedures was a direct Cabinet decision."*

The Department took part in an Inter-Department Uranium Task Force which dealt with the well water analyses. The Department's figures showed that six percent of 3,350 wells tested contained uranium concentration in excess of 20 parts per billion, the standard set for maximum acceptable concentration late in 1978 for Canadians.

A select Committee of the Legislature was set up on April 3, 1981.

The moratorium was announced September 22, 1981. *"Uranium exploration on existing licences essentially terminated at this time."* No new ones were issued, and all special ones expired as of May 6, 1982.

This Inquiry was announced January 22, 1982.

The Department policy was that no further licences would be issued pending the findings of the Inquiry. Uranium rights were protected by advising companies that they could submit a request to the Registrar of Mineral Rights. *"The area will then be withdrawn from further exploration for all minerals, and the request held on file ..."*

URANIUM AND NATURAL LEVELS OF RADIOACTIVITY

The physical and chemical properties of uranium, and natural levels of radioactivity in Nova Scotia were dealt with at pages 5-36, and included figures, maps and sketches including some maps in colour and maps showing well water studies.

Of special interest to the Inquiry was the reference (Page 19) that "perhaps the single most important geochemical feature of uranium, in discussing its mobility in nature, is its ability to be oxidized to the highly water soluble ion $U\,O_2.^+$ This ion is easily mobilized by near surface (oxidizing) waters and hence these waters can often alter the original uranium concentration of a rock mass. This alternation can be in the form of leaching (depletion of the original content) or enrichment (addition of uranium content by ions leached elsewhere). Factors controlling the mobility of uranium include the chemical composition of the affected rocks. pH (acidity) of the sub-surface waters with which the rocks are in contact, and climatic conditions. The enrichment of uranium by these processes can result in formation of an orebody. Circulating fluids of high UO_2^{++} ion content will precipitate uranium-bearing minerals when conditions of low oxidation are met."

It is also noted that *"highly concentrated pockets of radon gas are unlikely as its relatively short half life (3.8) days will result in decay to the nongaseous polonium-218 in a relatively short term."* Finds of uranium-226 and radon-222 in groundwater are often used by explorers looking for uranium deposits.

Several techniques were used by both levels of government by exploration companies - airborne and ground radiometric, geological and geochemical (regional till, lake sediment, stream sediment and well water) - to establish locations of uranium. One conclusion was that *"the southern mainland granites have a high content of uranium and thorium relative to the Cape Breton and Cobequid granites."*

EXPLORATION AND OCCURRENCES

To detect radiation is usually the first clue as to location of its source. Because gamma radiation can penetrate air and solid material more rapidly than alpha and beta radiation, the search often was for it.

The three instruments used were a geiger counter, a scintillometer or gamma ray spectrometer. The first was the least efficient. The

last could differentiate as to the radioactive element concerned.
In exploration, *"actual prospecting of the ground ... is perhaps the most useful and important tool."* The objective at the preliminary stage is to target a localized area of higher than average metal content (an anomaly). Then comes the initial stage, in which water and soil are tested. A flagged grid may be used. The advanced stage would follow, using trenching and drilling.
Procedures for these are set out in the Terms and Conditions attached to the special licences. If bulk testing is required, the licence must obtain an Ore Removal Permit from AECB if 10 kg. of uranium in Ore exceeding 0.05% (500 parts per million) is anticipated.
At the mine development stage, and underground exploration permit is required from AECB for detailed and systematic diamond drilling and significant excavation work. Studies would be controlled to determine if the mine site is viable and if the site is *"safe and environmentally acceptable"* and environmental impact studies are carried out for approval by AECB. These include a public information process.
Uranium (and thorium) occurrences in Nova Scotia were described at pages 43-58. (The state of progression is occurrence - interesting concentration in a locality, prospect - a significant amount of work done to determine the potential, and mine - removal for processing and sale).
At least one prospect at Millet Brook, *"might be of a mineable size"*," and *"the geological setting of Nova Scotia suggests that many of the granite rocks of Nova Scotia have excellent potential for uranium deposits"* of the vein type.

"A common feature, recognized here as well as in many other uranium regions world-wide, is the presence of what are called two mica granitic rocks. A two mica granitic rock is one which contains the two micas biotite and muscovite along with feldspars and quartz as the main rock forming minerals. These micas are not directly involved in the formation of uranium deposits, but the presence of two micas indicates that the parent magma from which the granitic rocks crystallized, had a high fluid and/or volatile phase incorporated in the molten magma. The amount and composition of this liquid and volatile phase is perhaps one of the most important factors in the dissolving, transporting and concentration of elements to form many types of ore deposits, including uranium. The liquid and volatile phase is therefore the medium or vehicle by which the ore elements are carried to a particular location and precipitated to form an ore deposit. Many of the granitic rocks of Nova Scotia, especially on the mainland, are two mica granitic rocks."

A second common feature of regions containing vein uranium deposits was the unusually high average uranium content relative to world averages for granitic rock. A third feature was the presence of associated deposits of tin and tungsten. When major exploration for uranium picked up, there was an increase in exploration for tin and tungsten (The East Kemptville, Yarmouth County, tin deposit was one result.)

At Millet Brook the uranium mineralizaiton consisted of zones of closely spaced veins, extending for over 1100 m at surface and at least 125 m depth. At East Dalhousie and Gaspereau Lake the veins were not sufficient to consider mining. Uranium vein deposits of Nova Scotia were best explained by a model (illustrated in the brief) or uranium deposited from hydrothermal solutions derived by a combination of meteoric and magmatic water.

The brief also noted low grade deposits in other parts of Nova Scotia - sedimentary basins in northern and north central Nova Scotia, erosion of the Cobequid highlands (p.55), limestone beds near South Maitland, Hants County (p.56), black shales in Cape Breton Island (p.57) and in Devonian volcanic rocks of the Cobequid Highlands (p.58).

RESPONSIBILITIES

The Mines Department administers the occupational health and safety programs for the mining industry. It carries out inspections of all mines and quarries under the authority provided by the Mineral Resources Act, the Coal Mines Regulation Act, and the Metaliferous Mines and Quarries Regulations Act. The Department administers the Health Act and Worker's Compensation regulations respecting first aid where they apply to mines and quarries.

Over 120 operations employing 2400 workers are inspected - exceptions are the DEVCO coal mines and certain gravel pits and quarries. The Department is part of an Interdepartmental Committee formed in 1975 and the Deputy Minister had to coordinate all matters related to occupational safety and health; and there is a Standing Technical Committee at the Director level which meets regularly.

"The prime vehicle for provincial control of a mining operation is the mine lease which is granted under the Mineral Resources Act." This Department and that of Environment must be satisfied before a lease is

granted. Uranium mining represents a unique constitutional situation (described previously). There was provincial control of uranium exploration activities, and federal-provincial cooperation with respect to health, safety and security existed. *"It is fair to say that problems with respect to this special constitutional arrangement regarding jurisdiction of uranium mines still exists."*

On April 3, 1981, the Minister of Development had given to the Legislature the position of the Government regarding uranium mining regulations. The intention was to "investigate all scientific and technical information related to the protection of workers, the public and the environment associated with the uranium mining cycle, and in particular the relevance of this data to potential uranium mining environments in Nova Scotia, to receive public input on these matters and to allow the opportunity for meaningful public review of all aspects of this investigation, and to determine terms and conditions, submissions requirements, prior to any evaluation of applications for leases to mine uranium, to ensure that, if approved, mining will be conducted under acceptable standards of worker and public safety, and the protection of the environment."

The Department had reached two conclusions in evaluating the uranium potential in Nova Scotia:

(1) "... there is a reasonable possibility that ... commercial deposits may be found and developed.

(2) on the basis of our present technical knowledge of the known uranium occurences, no commercial deposits of uranium currently exist in Nova Scotia. Only one significant prospect has been documented to date, and under the most optimistic continuing

success in developing proven uranium ore reserves, could not be in production for at least five years."

APPENDICES

- I - eight maps of areas held under exploration licences;
- II - compilation of assessment reports to the end of 1979 and an index map;
- III - compilation for 1980 and 1981 and an index map;
- IV - letter advising that coal, uranium, salt and potash had been placed in special licence category, and of documents dealing with licences, trepass and the intention to formulate guidelines for uranium exploration;
- V - first draft of such guidelines;
- VI - second draft of such guidelines;
- VII - terms and conditions governing special uranium exploration licences;
- VIII - policy statement regarding exploration for uranium and an information director regarding mineral land access to Municipal water supply lands.

236. NOVA SCOTIA WILDLIFE FEDERATION - STATEMENT

Moral support was given to other organizations who were opposed to uranium mining, and although it lacked the funds or expertise *"to mount any good campaign"* the NOVA SCOTIA WILDLIFE FEDERATION was opposed to such mining because it would seem to be *"a poor outlook for the future legacy of the forests and wildlife."*

Its president, MURRAY A. COVERT, concentrated on the environmental issue. The pollution which killed Ontario rivers for fifty miles from the mine would cross Nova Scotia entirely - indications of uranium in Nova Scotia were highest in concentration around the headwaters of watersheds, New Ross being a prime example. Most watersheds drained through prime farming and fishing - both sport and commercial areas. *"Where is the technology that guarantees that a tailings pond will not leak?"*

Another problem was the small amount of land available to the public. Only about 15-20% of Nova Scotia is Crown land, and some is tied up in leases. Any contamination of a watershed or river could make a significant reduction.

The brief considered that some of the mining interests presented a fair argument as to benefits, but the technology to prevent harmful effects is not yet available. Would the companies be as interested if they were obligated to use their profits for payment for the problems arising long after the mine had closed? Or for proponents to live in such areas? He thought answers would be a firm "NO".

AFTERWORD

These 44 public hearings concluded Phase I of the Inquiry. Its purpose was to elicit the views of people, interested in Nova Scotia and Nova Scotians, as to their perception of the problems raised by the presence of uranium. If somebody had special knowledge it could be contributed. If somebody did not, a presentation could still be made. In short, the Inquiry asked for voluntary contributions.

The Commissioner in line with this philosophy made his own contribution (drawn from many years as acting or Deputy Speakership of the House of Commons, Chairmanship of the Committee of the whole of the House of Commons or as Chairman or Acting Chairman of several House or joint committees of House and Senate; as judge of the Provincial Court, as Chairman of the Labour Relations Board of Nova Scotia) that is, the conduct of 44 meetings, without charge to the Province.

Although there was considerable emotion surrounding the Uranium question and about 6 incidents, no police were ever present during these hearings, no gavel was ever pounded, and the atmosphere provided was one as informal as possible. Certain improprieties were checked.

The Commissioner regretted, and said so at a post-Phase I meeting held in a courtroom, that certain presenters had gone too far in ascribing motives to others. It is of course commonly recognized that there are extreme positions by pro-uranium and anti-uranium mining forces. The report of the Commission was drawn from the positive points made by all presenters.

The purpose of the Digest was to put together the various points of view, and to give something of the flavour of each presenter. It was a conscientious effort to at least list the principal arguments. Should uranium prospecting, milling or use in Nova Scotia become an issue again, this Digest will help point out what pre-occupied Nova Scotians in 1982 about this very hazardous element. The briefs will also be available.

Finally, the Commissioner is grateful to all those who put together their opinions, presented them at public meetings, and made their presentations available for the public through this Digest. The Report that has emerged is made for Nova Scotians by the work of Nova Scotians or those interested in Nova Scotia. The three or four non-democratic elements have been heard and tolerated, and hopefully have a better understanding as to what the democratic process is all about which is one of the blessings of life in Nova Scotia.